VOLUME 25 / NUMBER 2
JANUARY 23, 1987
ACC. NOS. N87-10828 TO N87-11683

Technology and Science
Detroit Public Library

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

PRODUCED BY THE
SCIENTIFIC AND TECHNICAL
INFORMATION
BRANCH

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WHAT YOU CAN DO FOR *STAR*

All users of this abstract service are urged to forward reports to be considered for announcement in *STAR*. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those that you will transmit to NASA, DoD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Reprints of journal articles, book chapters, and conference papers are also welcome. These will be considered for announcement in *STAR's* companion journal, *International Aerospace Abstracts.*

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on public sale at the National Technical Information Service. Copyrighted publications will be announced but not distributed or sold.

PURCHASE OF *STAR*

The semimonthly issues are available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PUBLISHED BY:

UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION BRANCH
Scientific and Technical Aerospace Reports, Volume 25, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 22, 1988.

US ISSN 0036-8741

INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government Agencies, domestic and foreign institutions, universities, and private firms
- Translations in report form
- NASA-owned patents and patent applications
- Dissertations and theses

Journal, book, and conference literature, cover-to-cover journal translations, and certain foreign dissertations are announced in a companion journal, *International Aerospace Abstracts (IAA)*, available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

SUBJECT SCOPE

Subject scope of *STAR*, and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

OTHER NASA PUBLICATIONS

Other NASA publications and information services are described in the publication, *The NASA Scientific and Technical Information System ... and How to Use It*, available without charge from the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

HOW TO USE *STAR* SUBJECT CATEGORIES

STAR is categorized by 10 major subject divisions divided into 76 specific subject categories and one general category/division. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross-references. For example:

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Detroit Public Library

JAN 14 1987

Depository Document

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

WHAT YOU CAN DO FOR *STAR*

All users of this abstract service are urged to forward reports to be considered for announcement in *STAR*. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those that you will transmit to NASA, DoD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Reprints of journal articles, book chapters, and conference papers are also welcome. These will be considered for announcement in *STAR*'s companion journal, *International Aerospace Abstracts.*

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on public sale at the National Technical Information Service. Copyrighted publications will be announced but not distributed or sold.

PURCHASE OF *STAR*

The semimonthly issues are available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PUBLISHED BY:

UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION BRANCH
Scientific and Technical Aerospace Reports, Volume 25, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 22, 1988.

US ISSN 0036-8741

INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government Agencies, domestic and foreign institutions, universities, and private firms
- Translations in report form
- NASA-owned patents and patent applications
- Dissertations and theses

Journal, book, and conference literature, cover-to-cover journal translations, and certain foreign dissertations are announced in a companion journal, *International Aerospace Abstracts (IAA)*, available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

SUBJECT SCOPE

Subject scope of *STAR*, and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

OTHER NASA PUBLICATIONS

Other NASA publications and information services are described in the publication, *The NASA Scientific and Technical Information System ... and How to Use It*, available without charge from the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

HOW TO USE *STAR* SUBJECT CATEGORIES

STAR is categorized by 10 major subject divisions divided into 76 specific subject categories and one general category/division. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross-references. For example:

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Detroit Public Library

JAN 14 1987

Depository Document

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

CROSS-REFERENCES

Individual *STAR* abstracts are not ordinarily cross-referenced, except for certain conference reports or book translations that have had separate abstracts written for their component papers or chapters. Citations and abstracts of the components follow immediately after those of the parent document. When the subject content of a component differs sufficiently from the general content of the parent, a cross-reference citation also is printed at the end of the category to which it normally would have been assigned if it were independent.

DOCUMENTS ON MICROFICHE

Documents on microfiche(1) are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

AVAILABILITIES

One or more sources from which a document announced in *STAR* is available to the public is given in each citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page vii.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, as indicated above, for those documents identified by a # symbol.)

(1) A microfiche is a transparent sheet of film, 105 by 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26:1 reduction).

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts*. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address, both of which are on page vi.

Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free. (See discussion of NASA patents and patent applications below.)

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

NASA PATENTS AND PATENT APPLICATIONS

Patents and patent applications owned by NASA are announced in *STAR* under appropriate subject categories and are referenced in the *STAR* indexes. In the Report/Accession Number Index, patents are indexed by the NASA Case Number (which appears in lieu of the report number in other indexes), the U.S. Patent Number, the U.S. Patent Application Serial Number, and the U.S. Patent Class. Patent applications for which patents have not yet been issued are indexed by the NASA Case Number and the U.S. Patent Application Serial Number.

NASA *patent application specifications* are sold in paper copy by the National Technical Information Service at price code A02. Microfiche are sold at price code A01. The US-Patent-Appl-SN- number should be used in ordering either paper copy or microfiche from NTIS. Printed copies of *patents* (which are not microfiched) are available for purchase at $1.50 per copy from:

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, preferably by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the Patent and Trademark Office. The patents and patent applications announced in *STAR* are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

Assistant General Counsel for Patent Matters/Code GP
National Aeronautics and Space Administration
Washington, D.C. 20546

ELIGIBILITY AND REGISTRATION FOR NASA INFORMATION PRODUCTS AND SERVICES

A variety of services is available to organizations of the following types that have registered with NASA to receive specific services or products:

1. NASA offices, research centers, contractors, subcontractors, grantees, and consultants;
2. Other U.S. Government agencies and their contractors;
3. Libraries in the United States that have arrangements with NASA to maintain collections of NASA documents for public reference;
4. Other organizations in the United States having a need for NASA documents in work related to aeronautics and space research;
5. Organizations abroad that have established reciprocal document exchange arrangements with NASA.

Only the central service points or central points of document acquisition and control within qualified organizations are eligible to register for NASA products and services. Domestic organizations that may be eligible to receive various classes of NASA publications and services should address their requests for registration or for further information to:

NASA Scientific and Technical Information Facility
ATTN: Registration Activity
P.O. Box 8757
B.W.I. Airport, Maryland 21240

Organizations abroad should direct requests to the same address, but to the attention of: International Exchange Program.

AVAILABILITY OF *STAR* ABSTRACTS ON MICROFICHE

Microfiche of the abstract sections of this issue and other issues of *STAR* are available on annual subscription from NTIS, Attn: Subscriptions, 5285 Port Royal Road, Springfield, Virginia 22161. Annual subscription rates are $70.00 North America; $140.00 foreign. Abstract sections for previous years retroactive to 1964 are available at the current rates. Microfiche for individual *STAR* issue abstract sections are not available.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC: NASA and NASA-sponsored documents and a large number of aerospace publications are available to the public for reference purposes at the library maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019

EUROPEAN: An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols # and * from ESA - Information Retrieval Service European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris CEDEX 15, France.

FEDERAL DEPOSITORY LIBRARY PROGRAM

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 50 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 50 regional depositories. A list of the regional GPO libraries, arranged alphabetically by state, appears on the inside back cover. These libraries are *not* sales outlets. A local library can contact a Regional Depository to help locate specific reports, or direct contact may be made by an individual.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics and Astronautics
Technical Information Service
555 West 57th Street, 12th Floor
New York, New York 10019

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International, Ltd.
1495 Chain Bridge Road
McLean, Virginia 22101

ESDU International, Ltd.
251-259 Regent Street
London, W1R 7AD, England

Fachinformationszentrum Energie, Physik, Mathematik GMBH
7514 Eggenstein Leopoldshafen
Federal Republic of Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information Facility
P.O. Box 8757
B.W.I. Airport, Maryland 21240

National Aeronautics and Space Administration
Scientific and Technical Information Branch (NTT-1)
Washington, D.C. 20546

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library
National Center - MS 950
12201 Sunrise Valley Drive
Reston, Virginia 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, Arizona 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, Colorado 80225

NTIS PRICE SCHEDULES

(Effective January 1, 1987)

Schedule A
STANDARD PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	PAGE RANGE	NORTH AMERICAN PRICE	FOREIGN PRICE
A01	Microfiche	$ 6.50	$13.00
A02	001-025	9.95	19.90
A03	026-050	11.95	23.90
A04-A05	051-100	13.95	27.90
A06-A09	101-200	18.95	37.90
A10-A13	201-300	24.95	49.90
A14-A17	301-400	30.95	61.90
A18-A21	401-500	36.95	73.90
A22-A25	501-600	42.95	85.90
A99	601-up	*	*
NO1		45.00	80.00
NO2		48.00	80.00

Schedule E
EXCEPTION PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	NORTH AMERICAN PRICE	FOREIGN PRICE
E01	$ 7.50	15.00
E02	10.00	20.00
E03	11.00	22.00
E04	13.50	27.00
E05	15.50	31.00
E06	18.00	36.00
E07	20.50	41.00
E08	23.00	46.00
E09	25.50	51.00
E10	28.00	56.00
E11	30.50	61.00
E12	33.00	66.00
E13	35.50	71.00
E14	38.50	77.00
E15	42.00	84.00
E16	46.00	92.00
E17	50.00	100.00
E18	54.00	108.00
E19	60.00	120.00
E20	70.00	140.00
E99	*	*

*Contact NTIS for price quote.

IMPORTANT NOTICE

NTIS Shipping and Handling Charges

U.S., Canada, Mexico — ADD $3.00 per TOTAL ORDER

All Other Countries — ADD $4.00 per TOTAL ORDER

Exceptions — Does NOT apply to:

ORDERS REQUESTING NTIS RUSH HANDLING
ORDERS FOR SUBSCRIPTION OR STANDING ORDER PRODUCTS *ONLY*

NOTE: Each additional delivery address on an order requires a separate shipping and handling charge.

VOLUME 25 NUMBER 2 / JANUARY 23, 1987

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

01 AERONAUTICS (GENERAL) 157

02 AERODYNAMICS 157

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 160

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 161

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications and Radar.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 162

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

06 AIRCRAFT INSTRUMENTATION 163

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 163

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 164

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

09 RESEARCH AND SUPPORT FACILITIES (AIR) 165

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 166

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS 166

Includes powered and free-flight trajectories; and orbital and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 166

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES N.A.

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

16 SPACE TRANSPORTATION 167

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 168
Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.
For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

19 SPACECRAFT INSTRUMENTATION 177
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 178
Includes main propulsion systems and components, e.g. rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

23 CHEMISTRY AND MATERIALS (GENERAL) 178

24 COMPOSITE MATERIALS 179
Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

25 INORGANIC AND PHYSICAL CHEMISTRY 182
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS 184
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 186
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.
For composite materials see *24 Composite Materials.*

28 PROPELLANTS AND FUELS 187
Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

29 MATERIALS PROCESSING 188
Includes space-based development of products and processes for commercial application.
For biological materials see *55 Space Biology.*

ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) 188
Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR 189
Includes radar; land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 196
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 203
Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 207
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 210
Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

37 MECHANICAL ENGINEERING 210
Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 213
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 214
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES AND REMOTE SENSING 224

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 240

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

45 ENVIRONMENT POLLUTION 241

Includes atmospheric, noise, thermal, and water pollution.

46 GEOPHYSICS 242

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 247

Includes weather forecasting and modification.

48 OCEANOGRAPHY 264

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

51 LIFE SCIENCES (GENERAL) 265

52 AEROSPACE MEDICINE 265

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 BEHAVIORAL SCIENCES 266

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 266

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

55 SPACE BIOLOGY N.A.

Includes exobiology; planetary biology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 267

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE 268

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 COMPUTER SYSTEMS 273

Includes computer networks and special application computer systems.

63 CYBERNETICS 273

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS 274

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 277

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 278

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 278

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering.*

70 PHYSICS (GENERAL) 278

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

71 ACOUSTICS 279
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 280
Includes atomic structure, electron properties, and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 281
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 281
Includes light phenomena and optical devices.
For lasers see *36 Lasers and Masers.*

75 PLASMA PHYSICS 283
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 284
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 285
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 286
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 287
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 288
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 288
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 289
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 289
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 292
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 293
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 294
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 295
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

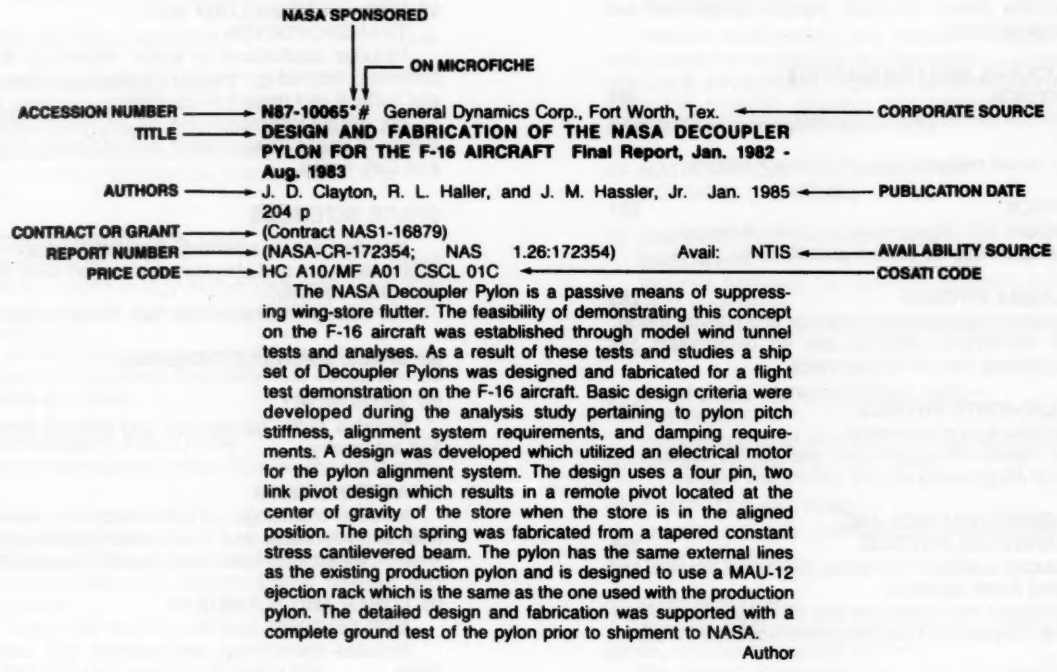
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL 295

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-47
CORPORATE SOURCE INDEX I-55
CONTRACT NUMBER INDEX I-67
REPORT/ACCESSION NUMBER INDEX I-69

TYPICAL CITATIONS AND ABSTRACTS


NASA SPONSORED
ON MICROFICHE
ACCESSION NUMBER
N87-10065* # General Dynamics Corp., Fort Worth, Tex.
CORPORATE SOURCE
TITLE
DESIGN AND FABRICATION OF THE NASA DECOUPLER PYLON FOR THE F-16 AIRCRAFT Final Report, Jan. 1982 - Aug. 1983
AUTHORS
J. D. Clayton, R. L. Haller, and J. M. Hassler, Jr. Jan. 1985
PUBLICATION DATE
204 p
CONTRACT OR GRANT
(Contract NAS1-16879)
REPORT NUMBER
(NASA-CR-172354; NAS 1.26:172354) Avail: NTIS
AVAILABILITY SOURCE
PRICE CODE
HC A10/MF A01 CSCL 01C
COSATI CODE
The NASA Decoupler Pylon is a passive means of suppressing wing-store flutter. The feasibility of demonstrating this concept on the F-16 aircraft was established through model wind tunnel tests and analyses. As a result of these tests and studies a ship set of Decoupler Pylons was designed and fabricated for a flight test demonstration on the F-16 aircraft. Basic design criteria were developed during the analysis study pertaining to pylon pitch stiffness, alignment system requirements, and damping requirements. A design was developed which utilized an electrical motor for the pylon alignment system. The design uses a four pin, two link pivot design which results in a remote pivot located at the center of gravity of the store when the store is in the aligned position. The pitch spring was fabricated from a tapered constant stress cantilevered beam. The pylon has the same external lines as the existing production pylon and is designed to use a MAU-12 ejection rack which is the same as the one used with the production pylon. The detailed design and fabrication was supported with a complete ground test of the pylon prior to shipment to NASA.
Author

VOLUME 25 NUMBER 2 / JANUARY 23, 1987

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N87-10828*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
GRADUATE ENGINEERING RESEARCH PARTICIPATION IN AERONAUTICS Final Report, period ending 31 Aug. 1986
A. Sidney Roberts, Jr. Aug. 1986 80 p
(Grant NGR-47-003-052)
(NASA-CR-179798; NAS 1.26:179798) Avail: NTIS HC A05/MF A01 CSCL 01B

The Aeronautics Graduate Research Program commenced in 1971, with the primary goal of engaging students who qualified for regular admission to the Graduate School of Engineering at Old Dominion University in a graduate engineering research and study program in collaboration with NASA Langley Research Center, Hampton, Virginia. The format and purposes of this program are discussed. Student selection and program statistics are summarized. Abstracts are presented in the folowing areas: aircraft design, aerodynamics, lift/drag characteristics; avionics; fluid mechanics; solid mechanics; instrumentation and measurement techniques; thermophysical properties experiments; large space structures; earth orbital dynamics; and environmental engineering. B.G.

N87-10829*# Kentron International, Inc., Hampton, Va.
NUMERICAL METHODS AND A COMPUTER PROGRAM FOR SUBSONIC AND SUPERSONIC AERODYNAMIC DESIGN AND ANALYSIS OF WINGS WITH ATTAINABLE THRUST CONSIDERATIONS
Harry W. Carlson and Kenneth B. Walkley Washington NASA Aug. 1984 78 p
(Contract NAS1-16000)
(NASA-CR-3808; NAS 1.26:3808) Avail: NTIS HC A05/MF A01 CSCL 01B

This paper describes methodology and an associated computer program for the design of wing lifting surfaces with attainable thrust taken into consideration. The approach is based on the determination of an optimum combination of a series of candidate surfaces rather than the more commonly used candidate loadings. Special leading-edge surfaces are selected to provide distributed leading-edge thrust forces which compensate for any failure to achieve the full theoretical leading-edge thrust, and a second series of general candidate surfaces is selected to minimize drag subject to constraints on the lift coefficient and, if desired, on the pitching moment coefficient. A primary purpose of the design approach is the introduction of attainable leading-edge thrust considerations so that relatively mild camber surfaces may be employed in the achievement of aerodynamic efficiencies comparable to those attainable if full theoretical leading-edge thrust could be achieved. The program provides an analysis as well as a design capability and is applicable to both subsonic and supersonic flow. Author

N87-10830# Air Force Test Pilot School, Edwards AFB, Calif.
PERFORMANCE AND QUALITY FLIGHT TEST TEXTBOOK. VOLUME 2: FLYING QUALITIES
Apr. 1986 1640 p
(AD-A168124) Avail: NTIS HC A99/MF A06 CSCL 01/2

Flying qualities is that discipline in the aeronautical sciences that is concerned with basic aircraft stability and pilot-in-the-loop controllability. With the advent of sophisticated flight control systems, vectored thrust, forward-swept wings, and negative static margins, the concept of flying qualities takes on added dimensions. In aeronautical literature there are three terms bandied about which are generally considered synonymous. These terms are flying qualities, stability and control, and handling qualities. Among others, the textbook contains the following articles: Introduction to Flying Qualities; Vectors and Matrices; Differential Equations; Equations of Motion; Longitudinal Static Stability; Maneuvering Flight; Lateral-Directional Static Stability; Dynamic Stability; Roll Coupling; High Angle of Attack; Engine-Out Theory and Flight Testing; Aeroelasticity; Feedback Control Theory, and Flight Control Systems. GRA

N87-10831# Assistant Secretary of Defense (Acquisition and Logistics), Washington, D.C.
MODEL DESIGNATION OF MILITARY AEROSPACE VEHICLES
J. Nataro Jun. 1986 127 p
(PB86-222429; DOD-4120.15-L) Avail: NTIS HC A07/MF A01 CSCL 01C

All aircraft in the Department of Defense Inventory, Air Force, Army, Navy, Marines, and Coast Guard are listed by Mission Design Series (MDS) and popular names. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N87-10832 British Aerospace Aircraft Group, Bristol (England). Aerodynamics Research Dept.
A BIBLIOGRAPHY OF AERODYNAMIC HEATING REFERENCES
J. R. Deane and P. C. Dexter Jul. 1982 80 p
(BAe-BT-13481; BAe-Aero-Inform-33; ETN-86-97948) Copyright. Avail: Issuing Activity

Almost 600 references on aerodynamic heating are listed in this bibliography. ESA

N87-10833 Kansas Univ., Lawrence.
AN EXPERIMENTAL INVESTIGATION OF DYNAMIC GROUND EFFECT Ph.D. Thesis
Ray Chung Chang 1985 108 p
Avail: Univ. Microfilms Order No. DA8608382

A wind-tunnel investigation has been made at low speed to determine the dynamic ground effect for low-aspect-ratio wings with sharp leading edges at constant angles of attack. The three main purposes of this investigation were: (1) to develop a wind tunnel simulation method that could provide dynamic ground effect data, (2) to demonstrate that the dynamic ground effect wind-tunnel testing could produce data comparable to flight test data, and (3) to provide information on the physical mechanisms involved in dynamic ground effect for highly swept delta wings. The dynamic ground effect data obtained from the wind-tunnel simulation provided a closer approximation to the actual flight test data than do static test data. For highly swept (6 deg. to 75 deg.), low-aspect-ratio wings static ground effect data greatly overpredicted the increase in C sub L, C sub D and C sub M as height over the span decreased below .4. For low-swept (lambda sub LE less than 30 deg.) low-aspect-ratio wings the discrepancy was much less. The visual observations of the flow field confirmed that vortex lag existed for highly swept, low-aspect-ratio wings in dynamic ground effect. Dissert. Abstr.

N87-10834# Centre d'Etudes et de Recherches, Toulouse (France). Dept. dEtudes et de Recherches en Aerothermodynamique.

REPORT ON TESTS OF A CAST 10 AIRFOIL WITH FIXED TRANSITION IN THE T2 TRANSONIC CRYOGENIC WIND TUNNEL WITH SELF-ADAPTIVE WALLS

A. Seraudie, A. Blanchard, and J. F. Breil Aug. 1985 266 p
(RT-OA-63/1685; DERAT-6/5019-DN) Avail: NTIS HC A12/MF A01

Described are tests on the CAST 10 airfoil in tripped-transition, carried out in the cryogenic and transonic wind-tunnel T2 fitted with self-adaptive walls. These tests follow those which were performed in natural transition and were presented in a previous note. Firstly, a complement was realized to pinpoint the location of the natural transition on the upper surface of the airfoil; this was done by a longitudinal exploration in the boundary layer. Secondly, in a first stage, the transition was only tripped on the lower surface with a carborundum strip of 0.045 mm thickness, situated at 5% of chord (T 1/2 D). These tests were performed here to separate the phenomena in relation to the lower surface and those in relation to the upper surface which occur in natural transition (TN). In a second stage, the transition was normally tripped on both sides of the profile (TD), likewise at x/c = 5% and h = 0.045 mm. The test configurations of the previous serial were experimented again and results obtained in the three cases (TN), (T 1/2 N) and (TD) were compared, in particular those concerned with the effect of the Reynolds number on aerodynamic coefficients of the airfoil. The gathering of the experimental values around a Reynolds number of 20 millions is observed; but before this number, the evolutions of the curves in the three cases tested are different. Author

N87-10835*# Sverdrup Technology, Inc., Arnold Air Force Station, Tenn.

LARGE PERTURBATION FLOW FIELD ANALYSIS AND SIMULATION FOR SUPERSONIC INLETS Final Report

M. O. Varner, W. R. Martindale, W. J. Phares, K. R. Kneile, and J. C. Adams, Jr. Sep. 1984 126 p
(Contract NAS3-23682)
(NASA-CR-174676; NAS 1.26:174676) Avail: NTIS HC A07/MF A01 CSCL 01A

An analysis technique for simulation of supersonic mixed compression inlets with large flow field perturbations is presented. The approach is based upon a quasi-one-dimensional inviscid unsteady formulation which includes engineering models of unstart/restart, bleed, bypass, and geometry effects. Numerical solution of the governing time dependent equations of motion is accomplished through a shock capturing finite difference algorithm, of which five separate approaches are evaluated. Comparison with experimental supersonic wind tunnel data is presented to verify the present approach for a wide range of transient inlet flow conditions. Author

N87-10836*# Bihrle Applied Research, Inc., Jericho, N. Y.

LOW SPEED ROTARY AERODYNAMICS OF F-18 CONFIGURATION FOR 0 DEG TO 90 DEG ANGLE OF ATTACK: TEST RESULTS AND ANALYSIS

Randy Hultberg Washington NASA Aug. 1984 255 p
(Contract NAS1-16205)
(NASA-CR-3608; NAS 1.26:3608) Avail: NTIS HC A12/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment, utilizing a rotary balance located in the Langley Spin Tunnel, are discussed and presented in tabular form for a 1/10 scale F-18 airplane model. The rotational aerodynamic characteristics were established for the basic airplane, as well as the influence of control deflections and the contribution of airplane components, i.e., body, wing, leading edge extension, horizontal and vertical tails, on these characteristics up to 90 deg angle of attack. Spin equilibrium conditions predicted using the measured data are also presented and compared with spin model and full scale flight results. Author

N87-10837*# Bihrle Applied Research, Inc., Jericho, N. Y.

ROTARY BALANCE DATA AND ANALYSIS FOR THE X-29A AIRPLANE FOR AN ANGLE-OF-ATTACK RANGE OF 0 DEG TO 90 DEG

John N. Ralston Washington NASA Aug. 1984 215 p
(Contract NAS1-16205)
(NASA-CR-3747; NAS 1.26:3747) Avail: NTIS HC A10/MF A01 CSCL 01A

The rotational aerodynamic characteristics are discussed for a 1/8 scale model of the X-29A airplane. The effects of rotation on the aerodynamics of the basic model were determined, as well as the influence of airplane components, various control deflections, and several forebody modifications. These data were measured using a rotary balance, over an angle of attack range of 0 to 90 deg, for clockwise and counter clockwise rotations covering an omega b/2V range of 0 to 0.4. Author

N87-10838*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECTS OF TAIL SPAN AND EMPENNAGE ARRANGEMENT ON DRAG OF A TYPICAL SINGLE-ENGINE FIGHTER AFT END

James R. Burley, II and Bobby L. Berrier Sep. 1984 136 p
(NASA-TP-2352; L-15742; NAS 1.60:2352) Avail: NTIS HC A07/MF A01 CSCL 01A

An investigation was conducted in the Langley 16 foot Transonic Tunnel to determine the effects of tail span and empennage arrangement on drag of a single engine nozzle/afterbody model. Tests were conducted at Mach numbers from 0.50 to 1.20, nozzle pressures frm 1.0 (jet off) to 8.0, and angles of attack from -3 to 9 deg, depending upon Mach numbers. Three empennage arrangements (aft, staggered, and forward) were investigated with several different tail spans. The results of the investigation indicate that tail span and position have a significant effect on the drag at transonic speeds. Unfavorable tail interference was largely due to the outer portion of the tail surfaces. The inner portion near the nozzle and afterbody did little to increase drag other than surface skin friction. Tail positions forward of the nozzle generally had lower tail interference. Author

N87-10839*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STATIC INTERNAL PERFORMANCE OF SINGLE-EXPANSION-RAMP NOZZLES WITH THRUST-VECTORING CAPABILITY UP TO 60 DEG

Bobby L. Berrier and Laurence D. Leavitt Oct. 1984 144 p
(NASA-TP-2364; L-15766; NAS 1.60:2364) Avail: NTIS HC A07/MF A01 CSCL 01A

An investigation has been conducted at static conditions (wind off) in the static-test facility of the Langley 16-Foot Transonic Tunnel. The effects of geometric thrust-vector angle, sidewall containment, ramp curvature, lower-flap lip angle, and ramp length on the internal performance of nonaxisymmetric single-expansion-ramp nozzles were investigated. Geometric thrust-vector angle was

varied from -20 deg. to 60 deg., and nozzle pressure ratio was varied from 1.0 (jet off) to approximately 10.0. Author

N87-10840*# Hamilton Standard, Windsor Locks, Conn.
EFFECT OF ANGULAR INFLOW ON THE VIBRATORY RESPONSE OF A COUNTER-ROTATING PROPELLER
J. E. Turnberg and P. C. Brown 15 Jan. 1985 75 p
(Contract NAS3-24222)
(NASA-CR-174819; NAS 1.26:174819) Avail: NTIS HC A04/MF A01 CSCL 01A

This report presents the results of a propeller vibratory stress survey on the Fairey Gannet aircraft aimed at giving an assessment of the difference in vibratory response between single and counter-rotating propeller operation in angular inflow. The survey showed that counter-rotating operation of the propeller had the effect of increasing the IP response of the rear propeller by approximately 25 percent over comparable single-rotation operation while counter-rotating operation did not significantly influence the IP response of the front propeller. Author

N87-10841*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC FLOW ANALYSIS FOR ROTORS. PART 2: THREE-DIMENSIONAL, UNSTEADY, FULL-POTENTIAL CALCULATION
I-Chung Chang Jan. 1985 27 p
(NASA-TP-2375; A-9682; NAS 1.60:2375) Avail: NTIS HC A03/MF A01 CSCL 01A

A numerical method is presented for calculating the three-dimensional unsteady, transonic flow past a helicopter rotor blade of arbitrary geometry. The method solves the full-potential equations in a blade-fixed frame of reference by a time-marching implicit scheme. At the far-field, a set of first-order radiation conditions is imposed, thus minimizing the reflection of outgoing wavelets from computational boundaries. Computed results are presented to highlight radial flow effects in three dimensions, to compare surface pressure distributions to quasi-steady predictions, and to predict the flow field on a swept-tip blade. The results agree well with experimental data for both straight- and swept-tip blade geometries. Author

N87-10842*# Rockwell International Corp., Los Angeles, Calif.
SUPERSONIC SECOND ORDER ANALYSIS AND OPTIMIZATION PROGRAM USER'S MANUAL
W. C. Clever Sep. 1984 223 p
(Contract NAS1-15820)
(NASA-CR-172342; NAS 1.26:172342) Avail: NTIS HC A10/MF A01 CSCL 01A

Approximate nonlinear inviscid theoretical techniques for predicting aerodynamic characteristics and surface pressures for relatively slender vehicles at supersonic and moderate hypersonic speeds were developed. Emphasis was placed on approaches that would be responsive to conceptual configuration design level of effort. Second order small disturbance theory was utilized to meet this objective. Numerical codes were developed for analysis and design of relatively general three dimensional geometries. Results from the computations indicate good agreement with experimental results for a variety of wing, body, and wing-body shapes. Case computational time of one minute on a CDC 176 are typical for practical aircraft arrangement. Author

N87-10843*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PILOTED SIMULATION STUDY OF THE EFFECTS OF AN AUTOMATED TRIM SYSTEM ON FLIGHT CHARACTERISTICS OF A LIGHT TWIN-ENGINE AIRPLANE WITH ONE ENGINE INOPERATIVE
Eric C. Stewart, Philip W. Brown, and Kenneth R. Yenni Nov. 1986 41 p
(NASA-TP-2633; L-16147; NAS 1.60:2633) Avail: NTIS HC A03/MF A01 CSCL 01A

A simulation study was conducted to investigate the piloting problems associated with failure of an engine on a generic light twin-engine airplane. A primary piloting problem for a light twin-engine airplane after an engine failure is maintaining precise control of the airplane in the presence of large steady control forces. To address this problem, a simulated automatic trim system which drives the trim tabs as an open-loop function of propeller slipstream measurements was developed. The simulated automatic trim system was found to greatly increase the controllability in asymmetric powered flight without having to resort to complex control laws or an irreversible control system. However, the trim-tab control rates needed to produce the dramatic increase in controllability may require special design consideration for automatic trim system failures. Limited measurements obtained in full-scale flight tests confirmed the fundamental validity of the proposed control law. Author

N87-10844# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INFLUENCE OF SHAPE ON VORTEX SHEDDING FROM TWO-DIMENSIONAL CYLINDERS AT HIGH REYNOLDS NUMBER AND HIGH SUBSONIC MACH NUMBER
Takeo Nakagawa, Gerd E. A. Meier, Rainer Timm, and Hans-M. Lent Oct. 1985 27 p Sponsored by Minna-James-Heinemann Foundation, Hannover, West Germany
(MPIS-22/1985; ISSN-0436-1199; ETN-86-98220) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21

The influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number was studied in wind tunnel tests. It is found that the overall scale of the formation region, which is the region just behind a body enclosed by the upper and lower separating shear layers, governs the vortex shedding phenomena. As the scale of the formation region increases, the amplitude and shape of the pressure become larger and more regular, respectively, and the amplitude of the pressure spectra at the fundamental frequency becomes larger, but the fundamental frequency (or vortex shedding frequency) itself decreases. ESA

N87-10845# Technische Hogeschool, Delft (Netherlands). Inst. for Wind Energy.
WIND TUNNEL EXPERIMENTS ON THE DIFFUSER CHARACTERISTICS OF A TIP VANE TURBINE
L. J. Vermeer Jul. 1985 33 p
(IW-R511; ETN-86-98483) Avail: NTIS HC A03/MF A01

Flow field measurements were done on a model of a tip vane turbine in a wind tunnel. The model consisted of two aerodynamic inactive extension rods with attached tip vanes. For better turbine simulation a circular gauze was mounted behind the rods. Using pitot tubes, static and total pressure measurements were carried out at several points along the radius of the model, for three different gauze porosities and several tip speed ratios. From these data the average values of the axial force coefficient and non-dimensional velocity through the rotor plane were calculated. Results were plotted in a so-called diffuser diagram and used for verification of a time averaged theory of the induction effect by tip vanes. ESA

N87-10846# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
UNSTEADY AIRLOAD COMPUTATIONS FOR AIRFOILS OSCILLATING IN ATTACHED AND SEPARATED COMPRESSIBLE FLOW
R. Houwink Apr. 1985 12 p Presented at joint AGARD FDP and FMP Symposium on Unsteady Aerodynamics: Fundamentals and Applications to Aircraft Dynamics, Goettingen, West Germany, 6-9 May 1985 Sponsored by Netherlands Agency for Aerospace Research
(NLR-MP-85040-U; B8668292; ETN-86-98491) Avail: NTIS HC A02/MF A01

Developments in coupled inviscid flow-boundary layer computations are discussed for airfoils in unsteady motion in attached and separated subsonic and transonic flow. The applicability of quasi-simultaneous strong interaction coupling procedures for transonic small perturbation theory and boundary layer integral

methods is illustrated for oscillating airfoils with shock-induced separation. The relevance of the predicted airloads for aeroelastic applications is illustrated using the analysis of an aeroelastic instability of a supercritical wing wind tunnel model. ESA

N87-10847# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
EULER FLOW SOLUTIONS FOR A TRANSONIC WIND TUNNEL SECTION
B. Koren Jan. 1986 18 p Submitted for publication Sponsored by Netherlands Technology Foundation
(CWI-NM-R8601; B8667670; ETN-86-98505) Avail: NTIS HC A02/MF A01

Two dimensional Euler flow computations were performed for a wind tunnel section, designed for research on transonic shock wave boundary layer interaction. For the discretization of the Euler equations, a finite volume Osher discretization was applied. The solution method is a nonlinear multigrid iteration with a symmetric point Gauss-Seidel relaxation method. Initial finest grid solutions are obtained by full multigrid. Grid adaptation was applied to obtain a sharp shock. The mathematical quality of four different boundary conditions for the oulet flow is indicated. The solutions of two transonic flows with shock are presented: a choked and a non-choked flow. Both flow solutions show good shock capturing. ESA

N87-10848 Notre Dame Univ., Ind.
THE TEMPORAL DEVELOPMENT OF A LOW-SPEED TWO-DIMENSIONAL JET IN A VISCOUS CROSS-FLOW Ph.D. Thesis
Joseph James Hoffman 1985 259 p
Avail: Univ. Microfilms Order No. DA8603598

The temporal development of a low speed, two-dimensional, viscous jet as it is ejected into a cross-flow is considered by means of a numerical integration of the Navier-Stokes equations and by an experimental investigation. The present analysis utilizes asymptotic expansions of the Navier-Stokes equations which are valid for small times after the start of the jet. These analytical solutions are used to initiate a numerical integration of the full Navier-Stokes equations. The experimental study considers the two-dimensional jet-in-cross-flow by ejecting fluid through a spanwise slot between two flat plates. Flow-visualization techniques were employed to photograph the temporal development of the flow-field. These results of the theoretical and experimental studies showed the formation of a recirculating region at the downstream edge of the jet. Results from both studies showed the recirculating region to expand in the streamwise and vertical direction with time. The ejection of the jet was terminated in the experimental studies, and the flow-visualization indicated that the fluid originating in the jet moved away from the wall and formed a vortex loop-like structure. The jet was not terminated in the numerical integration because of a discontinuity which would arise in the streamfunction field along the wall. Continuing the numerical integration with fluid being ejected from the slot, showed the separation streamline enclosing the recirculating region to detach from the slot edge at larger times and to convect along the wall. The numerical results at very large times suggest the possibility of the formation of a secondary recirculating region in the unseparated flow near the downstream slot edge, as well as the possibility of separation at the upstream edge of the slot.
Dissert. Abstr.

N87-10849 Stanford Univ., Calif.
COMPUTATION OF TRANSONIC SEPARATED WING FLOWS USING AN EULER/NAVIER STOKES ZONAL APPROACH Ph.D. Thesis
Unver Kaynak 1986 186 p
Avail: Univ. Microfilms Order No. DA8612751

A computer program called Transonic Navier Stokes (TNS) has been developed which solves the Euler/Navier-Stokes equations around wings using a zonal grid approach. In the present zonal scheme, the physical domain of interest is divided into several subdomains called zones and the governing equations are solved interactively. The advantages of the Zonal Grid Approach are as follows: (1) the grid for any subdomain can be generated easily, (2) grids can be, in, in a sense, adapted to the solution, (3) different equation sets can be used in different zones, and (4) this approach allows for a convenient data base organization scheme. Using this code, separated flows on a NACA 0012 section wing and on the NASA Ames WING C have been computed. First, the effects of turbulence and artificial dissipation models incorporated into the code are assessed by comparing the TNS results with other CFD codes and experiments. Then a series of flow cases are described where data is available. The computed results, including cases with shock-induced separation, are in good agreement with experimental data. Finally, some futuristic cases are presented to demonstrate the abilities of the code for massively separated cases which do not have experimental data.
Dissert. Abstr.

N87-10850 Michigan State Univ., East Lansing.
CHANGES IN THE TURBULENT BOUNDARY LAYER STRUCTURE ASSOCIATED WITH NET DRAG REDUCTION BY OUTER LAYER MANIPULATORS Ph.D. Thesis
Nasser Rashidnia 1986 253 p
Avail: Univ. Microfilms Order No. DA8613328

A specially designed wind tunnel was used to examine the effects of tandemly-arranged parallel plate manipulators (TAP-PMs) on turbulent boundary layer structure and the associated drag. Momentum balances and use of the velocity gradient near the wall were used to obtain the net drag and local skin friction changes. Measurements showed that local skin friction reductions were found from 20 delta sub 0 to as far as 120 delta sub 0. Two sets of plates, identical except for thickness were used. Results with .003' plates produced a maximum net drag reduction of 10% at 58 delta sub 0 using momentum balance. Downstream of this position the drag began to relax back to its unmanipulated level, and returned to normal by 100 delta sub 0. At 20 delta sub 0, simultaneous laser sheet flow visualization and hot-wire anemometry were used to conditionally sample the u prime, v prime, and u prime v prime information of the large eddies in both manipulated, and normal boundary layers at y/delta = .4 and .6. The frequency of occurrence of the footprints of the bursting process was also measured using flow visualization from a sublayer slit. The outward normal velocity of the inner region was significantly decreased at 20 delta sub 0 while the thickness of the sublayer increased by 10 to 20% throughout the 130 delta sub 0.
Dissert. Abstr.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N87-10851 Central Bureau of Statistics, Voorburg (Netherlands). Hoofafdeling Statistieken van Verkeer en Vervoer.
AVIATION STATISTICS, 1984 [STATISTIEK VAN DE LUCHTVAART]
1985 70 p Partly in DUTCH and ENGLISH Original contains color illustrations
(ISBN-90-357-0386-3; ISSN-0168-552X; ETN-86-98074)
Copyright. Avail: Issuing Activity

Statistics on world aviation and Dutch aviation are given. Graphs showing passenger transport and goods transport are presented. Data concerning commercial and noncommercial flights, passengers, and mail transport are tabulated. Flight and transport from Dutch airports are listed. ESA

N87-10852# National Transportation Safety Board, Washington, D. C.
NATIONAL TRANSPORTATION SAFETY BOARD SAFETY

RECOMMENDATION
11 Feb. 1986 17 p
Avail: NTIS HC A02/MF A01

Modifications were discussed for the following areas: detailed inspection of engine exhaust manifold assemblies, wye assemblies, turbo inlet elbow assemblies, and collector assemblies for cracks due to exhaust gas erosion in Cessna T310, 320, 340, 401, and 411 series aircraft and model 402, 402A, 402B, 414, 421, 421A, and 421B aircraft; fuel system contamination due to deteriorated sponge-filled fuel reservoir tanks; and weight calculation and balance for passenger loads that deviate from standard average weight. B.G.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications and Radar.*

N87-10853# Radio Technical Commission for Aeronautics, Washington, D. C. Special Committee 153.
MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AIRBORNE ILS GLIDE SLOPE RECEIVING EQUIPMENT OPERATING WITHIN THE RADIO FREQUENCY RANGE OF 328.6-335.4 MHz
Jul. 1986 71 p Revised
(RTCA/DO-192; RTCA/DO-132A-Rev) Avail: NTIS HC A04/MF A01; also available from RTCA Secretariat $25.00

This document was prepared by Special Committee 153 of the Radio Technical Commission for Aeronautics. It was approved by RTCA on July 18, 1986, and supersedes RTCA/DO-132A, Performance Standards Airborne ILS Glide Slope Receiving Equipment, November 2, 1978. RTCA is an association of aeronautical organizations of the United States from both government and industry. Dedicated to the advancement of aeronautics, RTCA seeks sound technical solutions to problems involving the application of electronics and telecommunications to aeronautical operations. Its objective is the resolution of such problems by mutual agreement of its member organizations. The findings of RTCA are in the nature of recommendations to all organizations concerned. Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the Federal government organization or agency having statutory jurisdiction over matters to which the recommendations relate. In preparation of these standards RTCA SC-153 took into consideration comments received on behalf of the European Organization for Civil Aviation Electronics (EUROCAE) WG-5. Author

N87-10854*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
POTENTIAL IMPACTS OF ADVANCED TECHNOLOGIES ON THE ATC CAPACITY OF HIGH-DENSITY TERMINAL AREAS
Robert W. Simpson, Amedeo R. Odoni, and Francisco Salas-Roche Oct. 1986 175 p
(Grant NAG1-472)
(NASA-CR-4024; NAS 1.26:4024) Avail: NTIS HC A08/MF A01 CSCL 17G

Advanced technologies for airborne systems (automatic flight control, flight displays, navigation) and for ground ATC systems (digital communications, improved surveillance and tracking, automated decision-making) create the possibility of advanced ATC operations and procedures which can bring increased capacity for runway systems. A systematic analysis is carried out to identify certain such advanced ATC operations, and then to evaluate the potential benefits occurring over time at typical US high-density airports (Denver and Boston). The study is divided into three parts: (1) A Critical Examination of Factors Which Determine Operational Capacity of Runway Systems at Major Airports, is an intensive review of current US separation criteria and terminal area ATC operations. It identifies 11 new methods to increase the capacity of landings and takeoffs for runway systems; (2) Development of Risk Based Separation Criteria is the development of a rational structure for establishing reduced ATC separation criteria which meet a consistent Target Level of Safety using advanced technology and operational procedures; and (3) Estimation of Capacity Benefits from Advanced Terminal Area Operations - Denver and Boston, provides an estimate of the overall annual improvement in runway capacity which might be expected at Denver and Boston from using some of the advanced ATC procedures developed in Part 1. Whereas Boston achieved a substantial 37% increase, Denver only achieved a 4.7% increase in its overall annual capacity. Author

N87-10855# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
OPERATING AND SUPPORT HAZARD ANALYSIS FOR SELF-CONTAINED NAVIGATION SYSTEM LSI MODEL 6216A, B AND C, GROUP B
John T. Reeves 30 May 1986 20 p
(Contract F09603-85-C-1224)
(AD-A169381; Rept-6216-019) Avail: NTIS HC A02/MF A01 CSCL 17/7

This document constitutes the Operating and Support Hazard Analysis (OSHA) for the C-130 Self-Contained Navigation System (SCNS) Group LRUs. It provides a hazard assessment of use and maintenance of the individual LRUs provided by LSI. The purpose of an OSHA is to identify and control hazards to personnel and to the system, or related to production, installation, maintenance, test, operation, etc. This OSHA is limited to design of the Group B LRUs as the design affects operational use and maintenance safety of personnel working in or around the equipment, including ground and flight crews. The SCNS is comprised of a Doppler Velocity Sensor (DVS), Inertial Navigation System (INS), Integration Computation and Display System (ICDS), and the associated installation Group A kit to provide Doppler aided INS navigation, INS only, Doppler only and TAS/HDG navigation modes, and control of the various C-130 communication/navigation (comm/nav) systems. The SCNS ICDS consists of three Integrated Control Display Units (ICDU) and one Bus Integration Computer Unit (BICU) for all C-130 aircraft except that the HC-130H will have an additional ICDU for the radio control. GRA

N87-10856# Sandia National Labs., Albuquerque, N. Mex.
GLOBAL POSITIONING SYSTEM MISSILE TEST RANGE APPLICATIONS
M. E. Partridge Jun. 1986 16 p
(Contract DE-AC04-76DP-00789)
(DE86-011994; SAND-85-2764) Avail: NTIS HC A02/MF A01

Using the Global Positioning System (GPS), a missile under test could transmit its own position, reducing radar tracking requirements while still providing three-dimensional position and velocity data with the required accuracy. This study investigated minimum package size requirements for GPS implementation on the SRAM II missile as part of the joint test assembly telemetry system. Reported GPS missile test range applications are reviewed. The two missile tracking system implementations considered are a complete GPS package onboard the missile and onboard frequency translator that retransmits the GPS satellite signals. Accuracy and operation of the two methods are compared. A functional description of the GPS is provided. DOE

N87-10857# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).
GRANAS: GLOBAL RADIO NAVIGATION SYSTEM Final Report, Apr. 1985
Hellmut Berner, Gerhard Brust, Helmut Euler, Joachim Nauck, and Klaus Plate Bonn, West Germany BMFT Dec. 1985 165 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-034; ISSN-0170-1339; ETN-86-97847) Avail: NTIS

HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 33

The costs of systems implementation, operation, and receiver of a navigation system of world-wide availability and high precision for general public users supplied by the global satellite-based navigation system Global Radio Navigation System are estimated. ESA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

N87-10858 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ENERGY MANAGEMENT OF 3-DIMENSIONAL MINIMUM-TIME INTERCEPT Ph.D. Thesis
Hendrikus Gerrit Visser 1985 124 p
Avail: Univ. Microfilms Order No. DA8605366

A real-time computer algorithm to control and optimize aircraft flight profiles is described and applied to a three-dimensional minimum-time intercept mission. The proposed scheme has roots in two well-known techniques; singular perturbations and neighboring-optimal guidance. Use of singular-perturbation ideas is made in terms of the assumed trajectory-family structure. A heading/energy family of prestored point-mass-model state-Euler solutions is used as the baseline in this scheme. The next step is to generate a near-optimal guidance law that will transfer the aircraft to the vicinity of this reference family. The control commands fed to the autopilot consist of the reference controls plus correction terms which are linear combinations of the altitude and path-angle deviations from reference values, weighted by a set of precalculated gains. In this respect the proposed scheme resembles neighboring-optimal guidance. However, in contrast to the neighboring-optimal guidance scheme, the reference control and state variables as well as the feedback gains are stored as functions of energy and heading in the present approach. A detailed description of the feedback laws and of some of the mathematical tools used to construct the controller is presented. Numerical examples, comparing open-loop optimal and approximate feedback solutions for a sample high-performance fighter, illustrate the attractiveness of the guidance scheme. Optimal three-dimensional flight in the presence of a terrain limit is studied in some detail. Dissert. Abstr.

N87-10859*# General Dynamics Corp., Fort Worth, Tex.
DESIGN AND FABRICATION OF THE NASA DECOUPLER PYLON FOR THE F-16 AIRCRAFT, ADDENDUM 2 Final Report, Jan. - Oct. 1984
J. D. Clayton, R. L. Haller, and J. M. Hassler, Jr. Feb. 1985 99 p
(Contract NAS1-16879)
(NASA-CR-172494; NAS 1.26:172494) Avail: NTIS HC A05/MF A01 CSCL 01C

The decoupler pylons which were originally designed and assembled with bushings in the pivot joints were retrofitted with roller bearings. This retrofit, the supporting analyses and the fixture tests of the modified pylons are reported in this document. The loads and stress analysis was directed toward the redesigned parts which were the pylon links and pins. The loads and stress analysis indicates that the pylons with the bearing installation have reduced capacity with respect to the bushing design. Fixture tests of the redesigned pylons were conducted in the GD/FW facility. Breakout friction tests and vibration tests were conducted. The tests show that the joint friction is approximately one-half the level with bearings as compared with the bushing installation. The vibration test data was used to tune the pylon mathematical simulation and this revised pylon simulation was used to recompute airplane modes of vibration. These computed modes of vibration were used in complete airplane symmetric and antisymmetric flutter and aeroservoelastic analyses. Author

N87-10860*# General Dynamics Corp., Fort Worth, Tex.
DESIGN AND FABRICATION OF THE NASA DECOUPLER PYLON FOR THE F-16 AIRCRAFT, ADDENDUM 1 Final Report, Aug. - Oct. 1983
J. D. Clayton and R. L. Haller Jan. 1985 70 p
(Contract NAS1-16879)
(NASA-CR-172355; NAS 1.26:172355) Avail: NTIS HC A04/MF A01 CSCL 01C

The results of the final analyses which were conducted using a revised structural simulation of the Decoupler Pylon are reported in this addendum. The simulation incorporates the previously published results of ground tests performed on the flight Decoupler Pylons mounted in a test fixture at General Dynamic's Fort Worth facility. The analyses show that the Decoupler Pylon will suppress wing-store flutter for the GBU-8 flight test stores configuration on an F-16 airplane. The feasibility of carrying a B-61 on the pylons is also investigated with the conclusion that the pylons would need to be modified in order to demonstrate flutter suppression. The results of a ground vibration test performed on the 1/4 scale F-16 flutter model and a wind tunnel test with this model and a model Decoupler Pylon are given. Author

N87-10861*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
X-29A LONGITUDINAL AND DIRECTIONAL FORCE AND MOMENT SUPPLEMENTAL TRANSONIC WIND TUNNEL TEST RESULTS
Albion H. Bowers Aug. 1984 289 p
(NASA-TM-85909; H-1257; NAS 1.15:85909) Avail: NTIS HC A13/MF A01 CSCL 01C

Aerodynamic data from NASA Ames Research Center's 11-Foot Transonic Wind Tunnel are plotted for the 1/8-scale X-29A forward-swept wing aircraft model. Eleven configurations were tested to provide supplemental data to investigate single surface failure modes, complex nonlinearities, and model buildup. These data can be used for control system refinements, pilot training, flight planning, and aerodynamic model validation. Data are presented as corrected wind tunnel data without analysis to document results that are being used for the aerodynamic model. Author

N87-10862*# Kansas Univ. Center for Research, Inc., Lawrence.
PARAMETRIC ANALYSIS OF A PASSIVE CYCLIC CONTROL DEVICE FOR HELICOPTERS
Hiroyuki Kumagai Oct. 1984 135 p
(Contract NCC2-175)
(NASA-CR-166608; NAS 1.26:166608; KU-FRL-568-1) Avail: NTIS HC A07/MF A01 CSCL 01C

A parametric study of a passive device which provides a cyclic longitudinal control moment for a helicopter rotor was performed. It utilizes a rotor blade tip which is structurally decoupled from the blade inboard section. This rotor configuration is generally called the Free-Tip Rotor. A two dimensional numerical model was used to review the Constant Lift Tip Rotor, a predecessor of the current configuration, and then the same model was applied to the Passive Cyclic Control Device. The Constant Lift Tip was proven to have the ability to suppress the vibratory lift loading on the tip around the azimuth and to eliminate a significant negative lift peak on the advancing tip. The Passive Cyclic Control Device showed a once-per-revolution lift oscillation with a large amplitude, while minimizing the higher harmonic terms of the lift oscillation. This once-per-revolution oscillation results in the cyclic moment to trim the rotor longitudinally. A rotor performance analysis was performed by a three dimensional numerical model. It indicated that the vortices shed from the junction between the tip and the inboard section has a strong influence on the tip, and it may severely limit the tip performance. It was also shown that the Free-Tip allows the inboard section to have a larger twist, which results in a better performance. Author

N87-10863# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
CORRELATION BETWEEN FLIGHT SIMULATION AND PROCESSING OF FLIGHT TESTS BASED ON INERTIAL MEASUREMENTS
A. M. H. Nieuwpoort, J. H. Breeman, L. J. J. Erkelens, and P. J. J. vanderGeest 19 Jul. 1985 23 p Presented at AGARD Flight Mechanics Panel Symposium of Flight Simulation, Cambridge, England, 3 Sep. - 3 Oct. 1985
(NLR-MP-85058-U; B8667020; ETN-86-98493) Avail: NTIS HC A02/MF A01

Flight tests and simulations were performed using conventional and dynamic techniques based on inertial measurements. The use of inertial sensors in flight testing implies that specific forces and body rates are determined which are directly employed in the flight path reconstruction procedure. This procedure uses the equations of motion governing flight. After this step aerodynamics model identification can take place. In flight simulation, the opposite process occurs. From the available aerodynamic and engine model specific forces and angular accelerations can be computed. Then the equations of motion can be integrated in order to determine the flight path. Consequently there is a strong similarity in the way flight test results are processed and reduced in order to obtain aerodynamic information and the way simulations are executed using a given model. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N87-10864*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND-BASED TIME-GUIDANCE ALGORITHM FOR CONTROL OF AIRPLANES IN A TIME-METERED AIR TRAFFIC CONTROL ENVIRONMENT: A PILOTED SIMULATION STUDY
Charles E. Knox and Nicole Imbert (Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France) Nov. 1986 36 p
(NASA-TP-2616; L-16116; NAS 1.60:2616) Avail: NTIS HC A03/MF A01 CSCL 01D

The rapidly increasing costs of flight operations and the requirement for increased fuel conservation have made it necessary to develop more efficient ways to operate airplanes and to control air traffic for arrivals and departures to the terminal area. One concept of controlling arrival traffic through time metering has been jointly studied and evaluated by NASA and ONERA/CERT in piloted simulation tests. From time errors attained at checkpoints, airspeed and heading commands issued by air traffic control were computed by a time-guidance algorithm for the pilot to follow that would cause the airplane to cross a metering fix at a preassigned time. These tests resulted in the simulated airplane crossing a metering fix with a mean time error of 1.0 sec and a standard deviation of 16.7 sec when the time-metering algorithm was used. With mismodeled winds representing the unknown in wind-aloft forecasts and modeling form, the mean time error attained when crossing the metering fix was increased and the standard deviation remained approximately the same. The subject pilots reported that the airspeed and heading commands computed in the guidance concept were easy to follow and did not increase their work load above normal levels. Author

N87-10865# Air Force Human Resources Lab., Brooks AFB, Tex.
LOW-COST AVIONICS SIMULATION FOR AIRCREW TRAINING Interim Report, Jan. 1984 - Jun. 1985
Bernell J. Edwards Jul. 1986 26 p
(AD-A169198; AFHRL-TR-85-38) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report documents the evaluation of a low-cost microcomputer based avionics system trainer as a substitute for aircraft-based training. The training was provided to C-141 pilots to train them to perform several procedural tasks associated with the operation of the Fuel Savings Advisory System (FSAS). This system is being retrofitted on C-141 and C5A aircraft. Operational aircrews must be trained to operate the FSAS in order to be mission qualified. This report documents an experiment in which trainees learned to operate the FSAS, either in the aircraft or via the low-cost alternative. Results showed both groups required the same amount of training time to learn to perform the tasks. Thus, the low-cost alternative was shown to be an effective substitute for the aircraft for training the FSAS tasks. A cost analysis comparing the two training methods shows the low-cost trainer is capable of avoiding more than 8 million dollars in training costs if it is employed to train current C-141 and C-5A aircrews in the FSAS tasks. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N87-10866*# Lockheed-Georgia Co., Marietta.
PTA TEST BED AIRCRAFT ENGINE INLET MODEL TEST REPORT, REVISED
J. P. Hancock May 1985 81 p
(Contract NAS3-24339)
(NASA-CR-174845; NAS 1.26:174845; LG85ER0012-Rev) Avail: NTIS HC A05/MF A01 CSCL 21E

The inlet duct test for the Propfan Testbed Assessment (PTA) program was completed in November 1984. The basic test duct was designed using the Lockheed QUADPAN computational code. Test objectives were to experimentally evaluate, modify as required, and eventually verify satisfactory performance as well as duct/engine compatibility. Measured total pressure recovery for the basic duct was 0.993 with no swirl and 0.989 for inflow with a 30 degree simulated swirl angle. This compared to a predicted recovery of 0.979 with no swirl. Measured circumferential distortion with swirl, based on a least-square curve fit of the data, was 0.204 compared to a maximum allowable value of 0.550. Other measured distortion parameters did as well or better relative to their respective maximum allowable values. The basic duct configuration with no refinements is recommended for the PTA inlet as a minimum cost installation. Author

N87-10867# Rolls-Royce Ltd., Derby (England).
FUTURE AERO-ENGINE CONTROL SYSTEMS, WHY FADEC? COST, DESIGN CYCLE TIMESCALE, RELIABILITY, WEIGHT AND SIZE TARGETS
H. F. Cantwell 14 Feb. 1986 13 p
(PNR-90298; ETN-86-98015) Avail: NTIS HC A02/MF A01

The requirements for a civil aircraft gas turbine control system are summarized. The advantages of full authority digital electronic control over hydromechanical concepts are outlined. ESA

N87-10868# Rolls-Royce Ltd., Derby (England).
ENGINE PERFORMANCE MONITORING FOR AIRLINES
John A. Chantry 6 Mar. 1986 15 p
(PNR-90305; ETN-86-98016) Avail: NTIS HC A02/MF A01

The costs and benefits of engine performance monitoring are recalled. The Rolls Royce engine monitoring system is described. ESA

N87-11191*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.
TURBINE AIRFOIL DEPOSITION MODELS
Daniel E. Rosner *In* NASA. Lewis Research Center Turbine Engine

Hot Section Technology, 1984 Oct. 1984 22 p (For primary document see N87-11180 02-39)
(Grant NAG3-201)
Avail: NTIS HC A17/MF A01 CSCL 21E

N87-11196*# Cleveland State Univ., Ohio.
MECHANICAL BEHAVIOR OF THERMAL BARRIER COATINGS FOR GAS TURBINE BLADES
Christopher C. Berndt, Woraphat Phucharoen, and George C. Chang *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
(Contract NCC3-27)
Avail: NTIS HC A17/MF A01 CSCL 21E

N87-11200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROTHERMAL MODELING PROGRAM, PHASE 2
Edward J. Mularz *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

N87-11203*# Oklahoma State Univ., Stillwater.
LATERAL JET INJECTION INTO TYPICAL COMBUSTOR FLOWFIELDS
David G. Lilley *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

N87-11205*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
BURNER LINER THERMAL/STRUCTURAL LOAD MODELLING
R. J. Maffeo *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 9 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

N87-11207*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
COMPONENT SPECIFIC MODELING
M. L. Roberts *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N87-10869*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROPOSED INPUT FOR DETERMINING LONGITUDINAL AERODYNAMIC PARAMETERS FOR THE SPACE SHUTTLE
William T. Suit Oct. 1984 33 p
(NASA-TM-85758; NAS 1.15:85758) Avail: NTIS HC A03/MF A01 CSCL 01C

A control input form to improve the identification of longitudinal aerodynamic parameters for the Space Shuttle, especially at low Mach numbers, has been proposed. This input combines features of several inputs currently used with the Shuttle to improve the response in angle-of-attack without exceeding pitch rate limits. The responses of the proposed input were generated using a simple three-degree-of-freedom simulation. An examination of the power spectral densities of these responses showed them to have more power near the vehicle natural frequency than doublet inputs previously used with the Shuttle. When the responses to the proposed input were corrupted with noise and processed using a maximum likelihood parameter extraction program, the identifiability of the parameters was improved over the identifiability of the same parameters using actual Shuttle responses from doublet input of a similar magnitude. This preliminary study indicates that the proposed input form should result in improved identifiability of longitudinal static and control parameters for the Shuttle vehicle. Author

N87-10870*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTERFERENCE EFFECTS OF THRUST REVERSING ON HORIZONTAL TAIL EFFECTIVENESS OF TWIN-ENGINE FIGHTER AIRCRAFT AT MACH NUMBERS FROM 0.15 TO 0.90
Francis J. Capone and Mary L. Mason Oct. 1984 104 p
(NASA-TP-2350; L-15811; NAS 1.60:2350) Avail: NTIS HC A06/MF A01 CSCL 01C

An investigation was conducted in the Langley 16 foot Transonic Tunnel to determine the interference effects of thrust reversing on horizontal tail effectiveness of a twin engine, general research fighter model at approach and in-flight speeds. Twin vertical tails at three longitudinal locations were tested at a cant angle of 0 deg. One configuration was also tested at a cant angle of 20 deg. Two nonaxisymmetric nozzle reverser concepts were studied. Test data were obtained at Mach numbers of 0.15, 0.60, and 0.90 and at angles of attack from -3 to 9 deg. Nozzle pressure ratios varied from jet off to 7.0, depending upon Mach number. At landing approach speed (Mach number 0.15), thrust reverser operation usually resulted in large variations (up to 70% increase) in horizontal tail effectiveness as nozzle pressure ratio was varied at zero angle of attack or as angle of attack was varied at constant nozzle pressure ratio. There was always a decrease in effectiveness at Mach numbers of 0.60 and 0.90 as a result of reverser operation. Author

N87-10871*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT-DETERMINED AERODYNAMIC DERIVATIVES OF THE AD-1 OBLIQUE-WING RESEARCH AIRPLANE
Alex G. Sim and Robert E. Curry Oct. 1984 40 p
(NASA-TP-2222; H-1179; NAS 1.60:2222) Avail: NTIS HC A03/MF A01 CSCL 01C

The AD-1 is a variable-sweep oblique-wing research airplane that exhibits unconventional stability and control characteristics. In this report, flight-determined and predicted stability and control derivatives for the AD-1 airplane are compared. The predictions are based on both wind tunnel and computational results. A final best estimate of derivatives is presented. Author

N87-10872# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.
EFFICIENCY OF VARIOUS CONTROL SURFACES IN STEADY AND UNSTEADY FLOW
R. Barreau, R. Destuynder, and G. Anders 2 Sep. 1985 71 p In FRENCH Presented at 61st AGARD Meeting on Structures and Materials Panel Subcommittee on Aeroelasticity, Oberammergau, West Germany, 9 Sep. 1985 Original language document was announced as A86-24633
(SNIAS-861-111-101; JBE/SB-443.524/85; ETN-86-97139) Avail: NTIS HC A04/MF A01

The three dimensional subsonic and transonic flow steady and unsteady effects associated with the action of control surfaces (ailerons, flaps and spoilers) were studied experimentally to improve the efficiency of aircraft control design. Large models provided with a large number of measuring points were tested in a wind tunnel. It is shown that the design of control surfaces applied to supercritical wings requires precautions. ESA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N87-10873 British Aerospace Aircraft Group, Warton (England).
DETAILS OF LOW SPEED INTAKE TEST FACILITY AT THE WARTON 2.7m X 2.1m WIND TUNNEL
30 Jan. 1986 9 p Original contains color illustrations
(BAe-AXM127; ETN-86-97942) Copyright. Avail: Issuing Activity

An intake/suction rig to assess inlet internal performance and engine face flow quality by simultaneous measurement of pressure recovery, time variant distortion, swirl and turbulence, for the full range of flight conditions from static/ground running to low speed, and the critical subsonic high incidence and sideslip combinations in wind tunnel tests was designed. Inlet duct performance and flow quality; ECS intake performance including simulation of the ECS duct, heat exchanger and ejector, with comprehensive diagnostic instrumentation; and air data system performance are also assessed. The rig consists of a twin compressed air powered ejector to power the two inlets; a strut mounted keelplate which can be adapted to carry various models (typically at 1/5th scale); and a comprehensive, 152mm dia, AIP rake. The 2.7m x 2.1m wind tunnel, using this rig, gives speeds from 0 to 45m/sec and a full range of alpha (-10 to +70 deg) and beta (-15 to +15 deg) to cover all flight conditions in one facility. ESA

N87-10874 British Aerospace Aircraft Group, Warton (England). Wind Tunnel Dept.
PRACTICAL EVALUATION OF WALL PRESSURE SIGNATURE CORRECTION METHODS IN THE 2.7m X 2.1m LOW SPEED WIND TUNNEL
J. G. Proctor Jan. 1986 69 p
(BAe-ARG-204; ETN-86-97943) Copyright. Avail: Issuing Activity

The chart and matrix methods of using wind tunnel wall static pressure distribution to calculate blockage and lift effects were assessed using pressure rails in a low speed wind tunnel. The use of tapped rails for pressure measurement proves suitable. Overall sampling rate is slow. Corrections for two larger flat plates agree well with published data. Conventional techniques are, however, as good. Compared to the standard, aircraft-model blockage corrections are lower than expected, possibly due to experimental technique. Incidence correction due to lift effect does not agree well with current methods, and care must be taken in the selection of singularity span. The methods cannot be considered as a viable replacement for current techniques. The results for the aircraft model at high incidence are disappointing, and the cause is not identified. ESA

N87-10875 British Aerospace Aircraft Group, Bristol (England). Civil Div.
PROP-FAN SLIPSTREAM EFFECTS USING STATIC SIMULATORS: LOW SPEED TASK, PHASE 1 Final Report
A. C. Willmes 5 Jul. 1985 49 p
(BAe-B59R/R-D/610/13498; RA/6/16/85; ETN-86-97944) Copyright. Avail: Issuing Activity

A device to produce a 14 inch diameter simulated prop fan slipstream was built and tested in a low speed wind tunnel. Tests were carried out with the simulator in front of a Vanguard model and an A320 model. Both models were tested with high lift systems deployed. Separate and combined effects of slipstream swirl and supervelocity components were investigated. The technique is considered to be established. Data for swept and straight wing aircraft at a variety of flap configurations is available. ESA

N87-10876*# National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL FACILITIES ASSESSMENT
Frank E. Panaranda, comp. Nov. 1985 204 p
(NASA-RP-1146; NAS 1.61:1146) Avail: NTIS HC A10/MF A01 CSCL 14B

A survey of the free world's aeronautical facilities was undertaken and an evaluation made on where the relative strengths and weaknesses exist. Special emphasis is given to NASA's own capabilities and needs. The types of facilities surveyed are: Wind Tunnels; Airbreathing Propulsion Facilities; and Flight Simulators Author

N87-10877# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
PAVEMENT RECYCLING: FACILITIES TECHNOLOGY APPLICATION TEST (FTAT) DEMONSTRATION, FY 84, FORT GILLEM, GEORGIA Final Report
Timothy Vollor May 1986 79 p
(AD-A169284; WES/TR/GL-86-4) Avail: NTIS HC A05/MF A01 CSCL 13/2

The objective of this project was to demonstrate and document the use of pavement recycling techniques. Most Army engineers at the working level have read about recycling but are hesitant to use recycling procedures because they do not have hands on experience. This pavement recycling demonstration was conducted at Fort Gillem, Ga., where both hot-mix and cold-mix recycling techniques were demonstrated. A four lane asphalt concrete pavement road serving as the main entrance to Fort Gillem was selected to demonstrate the hot-mix recycling technique. This road had been overlaid several times leaving the surface approximately 2 in. above the PCC curb and gutter. This caused a safety hazard and would have rendered the existing curbs and gutters useless if another overlay was done. Therefore, 4 in. of the pavement was removed using the cold milling process and a 2-in. hot-recycled mix was put back so that the pavement surface tied into the original curb. A two-lane asphalt concrete pavement road serving as the truck entrance to Fort Gillem was chosen to demonstrate cold recycling. This road had extensive alligator cracking which indicated a need to strengthen the existing pavement structure. The pavement structure was pulverized, an additional binder was added as an emulsion, and the material was compacted using a vibrator steel wheel roller and a 15-ton rubber tired roller. This produced an excellent base upon which a hot-mix recycle asphalt concrete wearing surface will be added. GRA

N87-10878# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.
THE HIGH SPEED CASCADE WIND TUNNEL: STILL AN IMPORTANT TEST FACILITY FOR INVESTIGATIONS ON TURBOMACHINERY BLADES
Heinz Hoheisel Mar. 1986 36 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-86-11; ISSN-0176-7739; ETN-86-98179) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 14

The importance of the high speed cascade wind tunnel was demonstrated. Starting from the conception of this wind tunnel and the requirements for cascade wind tunnels in which compressible flows have to be studied, the usability and qualification of this test facility for research work is described with examples of turbine and compressor cascade investigations. Necessary additional equipment is discussed. ESA

N87-10879# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelung.
OPTIMAL CONTROL: A SYSTEMATIC AID FOR THE COMPUTER AIDED EXPLORATION OF THE DYNAMIC POSSIBILITIES OF A CRYOGENIC WIND TUNNEL Ph.D. Thesis - Ruhr Univ.
Dieter Kraft Jun. 1986 215 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-23; ISSN-0171-1342; ETN-86-98188) Avail: NTIS HC A10/MF A01; DFVLR, Cologne, West Germany DM 63

The dynamic systems behavior of a cryogenic wind tunnel was analyzed for an automatic control system which meets the

stringent safety requirements and operating specifications in a wide domain of operation. For cost, safety and availability reasons this analysis cannot be performed on the real tunnel, but must be conducted on a mathematical model. The dynamic behavior of the wind tunnel is characterized by strongly coupled nonlinear differential equations; therefore optimal control was applied for analysis. The boundary values of the system are the basis of comparison for the different steps of the analysis, while the control and state constraint and their variations resulting from the operating specifications represent systematic step sizes along which the dynamic spectrum was explored. This procedure yields statements about the robustness of nonlinear systems. Direct numerical methods for the solution of optimal control problems are described. ESA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N87-10880# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
EUROPEAN UTILIZATION ASPECTS OF LOW EARTH ORBIT SPACE STATION ELEMENTS, PHASE 3, VOLUME 2 Final Report
Paris ESA Oct. 1985 755 p Prepared in cooperation with Aeritalia S.p.A., Torino, Rome, British Aerospace Aircraft Group, Bristol, England, Domier-Werke GmbH, Friedrichshafen, West Germany, Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost, Netherlands, Instituto Nac
(Contract ESA-5234/82-F-FC(SC))
(ESA-CR(P)-2219; ETN-86-98099) Avail: NTIS HC A99/MF E03

European utilization aspects of space station pressurized module, and co-orbiting, polar and free-flying platforms are summarized. Materials science; life sciences; Earth observation; technology and communication; user interfaces; payload handling; and user data bases are covered. ESA

N87-10881# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
STUDY ON A DROP AND BUBBLE UNIT. VOLUME 1: EXECUTIVE STUDY Final Report
G. Boerchers, R. Bohlen, J. Herzog, C. Milan, J. Schawer, W. Heide, D. Langbein, E. G. Lierke, G. Seger, and P.-O. Doittau Paris ESA Dec. 1983 66 p
(Contract ESA-5503/83-F-FC(SC))
(ESA-CR(P)-2256; ETN-86-98133) Avail: NTIS HC A04/MF A01

Equipment concepts for investigations on bubbles, drops and particles in liquid matrices in microgravity were studied. Experiments, proposed and/or performed with other facilities and available equipment were investigated. A concept for a drop and bubble unit (BDPU) consisting of modular elements which can be configured into a required facility was elaborated. Necessary subsystems were indentified and concepts were established. A BDPU configuration is proposed. Planning and cost estimation for development, manufacturing, and test of the BDPU were performed. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N87-10882 Washington Univ., Seattle.
DESIGN OF CONTROL LAWS FOR ADAPTIVE SIGNAL TRACKING SYSTEMS Ph.D. Thesis
Jenq-Tzong H. Chan 1986 266 p
Avail: Univ. Microfilms Order No. DA8613150

This dissertation develops and analyzes a novel approach to the synthesis of adaptive controllers for single-input single-output systems with uncertain parameters operating in a stochastic disturbance environment. The proposed algorithm, formulated in discrete time domain, is based on the certainty-equivalence principle. It combines a recursive extended least squares parameter estimation algorithm with an optimal feedback regulator/feedforward signal tracking controller in an indirect model reference adaptive scheme. The control law synthesis is based on the discrete version of generalized singular linear quadratic control theory. In this approach, only the signal error is penalized in the controller performance index and naturally leads to the feedback/feedforward control structure. The stability and performance characteristics of the proposed algorithm are analyzed both analytically and via selected simulations. It is shown that the algorithm performs acceptably in situations where many current algorithms are known to fail. An instability mechanism for indirect adaptive schemes is identified and analyzed. As a result, an approach is suggested that could lead to improved robustness of this algorithm without impacting the performance of the system. Dissert. Abstr.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N87-10883*# Boeing Aerospace Co., Kennedy Space Center, Fla.
ORBITAL TRANSFER VEHICLE LAUNCH OPERATIONS STUDY: AUTOMATED TECHNOLOGY KNOWLEDGE BASE, VOLUME 4 Final Report
7 Mar. 1986 124 p
(Contract NAS10-11165)
(NASA-CR-179706; NAS 1.26:179706) Avail: NTIS HC A06/MF A01 CSCL 22D

A simplified retrieval strategy for compiling automation-related bibliographies from NASA/RECON is presented. Two subsets of NASA Thesaurus subject terms were extracted: a primary list, which is used to obtain an initial set of citations; and a secondary list, which is used to limit or further specify a large initial set of citations. These subject term lists are presented in Appendix A as the Automated Technology Knowledge Base (ATKB) Thesaurus. M.G.

N87-10918# Centre National d'Etudes Spatiales, Paris (France).
FEASIBILITY STUDY OF A LAUNCHER VIBRATION ENVIRONMENT SIMULATOR [ETUDE DE FAISABILITE D'UN SIMULATEUR D'AMBIANCE VIBRATOIRE DE LANCEUR]
H. J. P. Morand, B. Chemoul, F. Celle, J. P. Gauthier, F. Rouvrais (Intespace, Toulouse, France), and S. Michel *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 241-245 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-11042*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
UNATTENDED DEEP SPACE STATION TRACKING STATION DEVELOPMENT: MONITOR AND CONTROL TECHNOLOGY
C. Foster *In its* The Telecommunications and Data Acquisition Report (date) p 164 - 170 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N87-10900# Centre National d'Etudes Spatiales, Paris (France).
LAUNCHER-PAYLOAD DYNAMIC INTERACTION [INTERACTION DYNAMIQUE LANCEUR-CHARGE UTILE]
H. J.-P. Morand, B. Chemoul, and P. R. Bodagala *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 101-108 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10902# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. of Aeroelasticity.
VERIFICATION OF THE MATHEMATICAL MODEL OF THE ARIANE 4 PAYLOAD FAIRING BY MEANS OF EXTENDED MODAL SURVEY TESTING
A. Bertram and P. Villalaz (Contraves Corp., Zurich, Switzerland) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 113-118 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10937# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
INVESTIGATION OF THE COUPLING OF THE HERMES VEHICLE TO THE ARIANE 5 LAUNCHER [ETUDE DE L'ACCROCHAGE DU VEHICULE HERMES SUR LE LANCEUR ARIANE 5]
M. Agrain *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 375-380 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N87-10884*# Analytical Mechanics Associates, Inc., Hampton, Va.
SUMMARY OF SHUTTLE DATA PROCESSING AND AERODYNAMIC PERFORMANCE COMPARISONS FOR THE FIRST 11 FLIGHTS Final Report
John T. Findlay, G. Mel Kelly, Michael L. Heck, and Judy G. McConnell Sep. 1984 126 p
(Contract NAS1-16087)
(NASA-CR-172440; NAS 1.26:172440; AMA-84-10) Avail: NTIS HC A07/MF A01 CSCL 22A

NASA Space Shuttle aerodynamic and aerothermodynamic research is but one part of the most comprehensive end-to-end flight test program ever undertaken considering: the extensive pre-flight experimental data base development; the multitude of spacecraft and remote measurements taken during entry flight; the complexity of the Orbiter aerodynamic configuration; the variety of flight conditions available across the entire speed regime; and the efforts devoted to flight data reduction throughout the aerospace community. Shuttle entry flights provide a wealth of research quality data, in essence a veritable flying wind tunnel, for use by researchers to verify and improve the operational capability of the Orbiter and provide data for evaluations of experimental facilities as well as computational methods. This final report merely summarizes the major activities conducted by the AMA, Inc. under NASA Contract NAS1-16087 as part of that interesting research. Investigators desiring more detailed information can refer to the glossary of AMA publications attached herein as Appendix A. Section I provides background discussion of software and methodology development to enable Best Estimate Trajectory (BET) generation. Actual products generated are summarized in Section II as tables which completely describe the post-flight products available from the first three-year Shuttle flight history. Summary results are presented in Section III, with longitudinal performance comparisons included as Appendices for each of the flights. Author

N87-10885# British Aerospace Public Ltd. Co., Stevenage (England). Space and Communications Div.
TECHNOLOGY DEMONSTRATION PROGRAMME, PHASE 2 STUDY Final Report
B. J. Emery, comp. Paris ESA Oct. 1985 214 p
(Contract ESA-5990/84-NL-PP(SC))
(BAe-TP-8207; ESA-CR(P)-2218; ETN-86-98098) Avail: NTIS HC A10/MF A01

The concept of a low cost flexible carrier based on the Spacelab Half Pallet was defined. Carrier subsystems, launch vehicle requirements and the program logistics using a generic primary payload were emphasized. The primary payload was selected from a list of experiments which represented the technology expected to be flown in future ESA programs. Results show that the Half Pallet is suitable as a low cost carrier for use with in orbit technology demonstration experiments. ESA

N87-10888# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE PAYLOAD DESIGN AND DEVELOPMENT
Donald C. Wade and David A. Hamilton *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 11-16 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10905# Astron Research and Engineering, Santa Monica, Calif.
ACOUSTIC LOAD CONSIDERATIONS FOR SPACECRAFT STRUCTURES
J. F. Wilby and A. G. Piersol *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 133-143 Sponsored by NASA (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N87-11039*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
ANTENNA ARRAYING OF VOYAGER TELEMETRY SIGNALS BY SYMBOL STREAM COMBINING
W. J. Hurd, J. Rabkin, M. D. Russell, B. Siev, H. W. Cooper, T. O. Anderson, and P. U. Winter *In its* The Telecommunications and Data Acquisition Report (date) p 131 - 142 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N87-10886# European Space Agency, Paris (France).
PROCEEDINGS OF AN INTERNATIONAL CONFERENCE ON SPACECRAFT STRUCTURES
W. R. Burke, comp. Apr. 1986 433 p In ENGLISH and FRENCH Conference held in Toulouse, France, 3-6 Dec. 1985
(ESA-SP-238; ISSN-0379-6566; ETN-86-98078) Avail: NTIS HC A19/MF A01

Spacecraft structural analysis, including dynamic analysis and tests, dynamical identification, and acoustics analysis; design engineering; and spacecraft construction materials were discussed. For individual titles, see N87-10887 through N87-10943.

N87-10887# Arianespace, Evry (France).
RESULTS OF ARIANE LAUNCH VEHICLE FLIGHTS AND THEIR EFFECTS ON THE SIZING OF SATELLITE STRUCTURES [RESULTATS DES VOLS DU LANCEUR ARIANE ET LEURS EFFETS SUR LE DIMENSIONNEMENT DES STRUCTURES DE SATELLITES]
M. Vedrenne, J. P. Dulout, and J. L. Caneilles *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 3-10 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Low frequency (up to 100 Hz) vibrations caused by transitory events during critical flight phases of Ariane, such as wind gusts at maximum dynamic pressure, and motor shutdown, are discussed. Frequency amplitude vibration measurements at satellite interfaces are compared with predictions from analyses of the coupled mode launcher-satellite system. Overall results are compared with the environment specified in the Ariane user guide for satellite dimensioning and testing. A simplification of the low frequency environment is proposed. ESA

N87-10888# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE PAYLOAD DESIGN AND DEVELOPMENT **c16**
Donald C. Wade and David A. Hamilton *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 11-16 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The structural design guidelines and requirements for payloads launched on the Space Shuttle are reviewed. Experience with scientific and commercial satellites and experiments is presented. Structural requirements for payloads are divided into the areas of mechanical interfaces, load environments, and materials. The mechanical interfaces include physical sizing allowables, attachment mechanisms, attach point locations, and remote manipulator system requirements. The structural loading environments include preliminary design load factors, random vibration, and acoustics. Coupled-loads analysis requirements and methodology are discussed along with payload math model characteristics. Frequency restrictions to avoid flight control interaction are defined. Requirements and options for strength certification, math model verification, and materials-related design requirements are discussed. ESA

N87-10889# Technische Hogeschool, Delft (Netherlands).
ABOUT THE DEVELOPMENT OF INTERACTIVE SHELL DESIGN CODES **c61**
Johann Arbocz *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 19-26 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The development of the Delft Interactive Shell Design Code is described. The purpose of this project is to make the accumulated theoretical, numerical and practical knowledge of the last 20 years readily accessible to users interested in the design of buckling sensitive thin-walled shell structures. With this open-ended, hierarchical, interactive computer code, the user can successively access from the workstation programs of different complexity. At every step of analysis the user can call upon extensive HELP files containing information about potential design solutions. ESA

N87-10890# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Mechanical Systems Div.
DESIGN AND VERIFICATION ACTIVITIES AND REQUIREMENTS FOR SPACECRAFT STRUCTURES
C. Stavrinidis *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 27-33 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The scope and associated cost related with spacecraft structures design and verification are discussed. These depend on such factors as the geometrical dimensions of the spacecraft, weight criticality and the degree of dynamic interaction of the spacecraft with the launch vehicle. For large complex spacecraft which often have significant dynamic interaction with the launch vehicle, structural design and verification usually require a combination of analysis, development testing, and qualification testing. ESA

N87-10891# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ON OPTIMAL PASSIVE AND ACTIVE CONTROL OF PRECISION SPACECRAFT STRUCTURES
H. Baier *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 35-39 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The application of structural optimization and control methods for precision spacecraft structures is discussed. The necessity of proper decomposition into subproblems is emphasized. The shape adjustment and control of an antenna reflector is considered and results are presented. In the dynamic regime, active isolation is applied for a sensitive payload and the benefit of such an approach is outlined. For passive design purposes a control forces approach which is numerically efficient but does not necessarily lead to an optimum is used. ESA

N87-10892# Societe Nationale Industrielle Aerospatiale, Cannes (France).
TRUSS STRUCTURE WITH GREAT DIMENSIONAL STABILITY: PRINCIPLE OF DESIGN, DEVELOPMENT, CERTIFICATION [STRUCTURE TREILLIS A GRANDE STABILITE DIMENSIONNELLE: PRINCIPE DE CONCEPTION - DEVELOPPEMENT - QUALIFICATION]
B. Verez and J. L. Devaux *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 41-49 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Carbon fiber composite trusses for space applications are discussed. Antenna supports and optical mountings are described. Design and verification principles are outlined. Dimensional stability problems due to the mechanical and thermal environments, and to desorption and humidity are stressed. ESA

N87-10893# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Mechanical Systems Div.
ESA FRACTURE CONTROL POLICY AND FRACTURE MECHANICS SPECTRA FOR STS PAYLOADS **c39**
G. G. Reibaldi, A. A. tenHave, A. U. deKoning, and J. Ph. vanHerwaarden (Royal Netherlands Aircraft Factories Fokker, Amsterdam) *In* ESA Proceedings of an International Conference

on Spacecraft Structures Apr. 1986 p 51-55 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

In order to standardize the fatigue load spectra used in the design of European payloads to be flown on the Space Shuttle, the European Space Agency evaluated acceleration flight data from several Space Shuttle missions. Data were derived from a variety of payload mass, size, location, and complexity to be as general as possible. Fracture mechanics loading spectra verification and correct prediction is considered very important for complex payloads and space station elements. Requirements for materials properties, stress intensity solutions, crack growth prediction algorithms, loading spectra, nondestructive inspection, fracture of composites, creep, and probabalistic fracture mechanics are discussed. ESA

N87-10894# Engineering System International, Rungis (France).
EQUIVALENT CONTINUUM ANALYSES OF LARGE SPACE TRUSSES
E. Haug, P. Dowlatyari, and J. Dubois *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 57-65 (For primary document see N87-10886 02-18)
(Contract ESTEC-5209/82-NL-PB(SC))
Avail: NTIS HC A19/MF A01

The techniques of discrete field methods, conventional equivalent continua, and micropolar equivalent continua are introduced, and their usefulness for the calculation of large space structures and their ease of numerical implementation are assessed. An example of a large space truss was run on the computer, using the full model, and several equivalent continuum finite element models. The full and equivalent continuum models of the chosen realistic sample space truss are loaded statically with mechanical load cases characteristic of orbital transfer conditions and with thermal gradients which might arise in operating conditions. Dynamic behavior is studied by extracting vibration frequencies and mode shapes. Results suggest that it is better to channel development efforts into an integrated sandwich finite element, uniting anisotropic membrane skins and an anisotropic brick or thick shell core into one element. This type of element is likely to be useful as an equivalent continuum finite element for most practical space trusses. ESA

N87-10895# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
ANALYSIS OF LONG THIN-WALLED TUBES
B. Geier and A. K. Rath (Indian Space Research Organization, Trivandrum) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 67-72 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Analysis of thin walled composite tubes for large space structures under buckling loads is discussed. Material law, nonlinear theory of anisotropic shells, computation of fundamental states, and computation of buckling loads are considered. ESA

N87-10896# Texas Univ., Austin.
A STUDY OF NODAL COUPLING METHODS c39
R. R. Craig *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 75-80 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Component mode synthesis time-domain methods for undamped structures are introduced. Component normal modes with fixed or free boundaries, constraint modes, and inertia-relief attachment modes are described. An inertia attachment mode is defined. System eigensolutions based on various component mode sets are compared. Work on the application of attachment modes to modal control of flexible structures is noted. ESA

N87-10897# Intespace, Toulouse (France).
EFFECTIVE MODAL PARAMETERS AND TRUNCATION EFFECTS IN STRUCTURAL DYNAMICS [PARAMETRES MODAUX EFFECTIFS ET EFFETS DE TRONCATURE EN DYNAMIQUE DES STRUCTURES] c39
A. Girard and J. F. Imbert *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 81-86 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Modal superposition techniques used to calculate the low frequency response of structures are discussed. A unified approach to the effective modal parameters method of interpreting eigenmodes is outlined. These parameters obey summation rules to reconstruct the corresponding static properties, enabling truncation effects to be estimated in terms of residual parameters representing the global contribution of higher modes. This reveals the role of flexibility, mass, transmissibility, and effective strains. ESA

N87-10898# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DAMPING REPRESENTATION RELATED TO SPACECRAFT STRUCTURAL DESIGN
Eckhard Hilbrandt *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 87-92 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Analysis methods for damping representation and damping prediction and design measures to enhance damping properties of space structures are reviewed. Isolation (filtering) absorption, and discrete and continuous dampers (damping layers) are discussed. Test results on beam and plate structures are compared to analytical models. It is shown that a design for damping concepts in spacecraft structures may significantly reduce the response levels and thus have a beneficial effect on equipment design. ESA

N87-10899# Cisigraph, Rungis (France).
FLUID-STRUCTURE INTERACTION: MODAL SYNTHESIS METHOD [INTERACTION FLUIDE STRUCTURE: METHODE DE SYNTHESE MODALE] c39
R. Savouillan, F. Besnier, and G. Rozenblum *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 93-99 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Modal analysis of structures in the presence of compressible or incompressible fluids, with or without surface waves is discussed. The fluid is modeled using three dimensional or axysmmetric elements, the variables being the pressure within the fluid. Application of a modal synthesis method to incompressible, quasi compressible and highly compressible fluids is compared with a direct method as to accuracy and performance. Different choices of modal base are examined. The direct method is treated rigorously, particularly for the free surface case, with calculation of modal pressures. The integration of these developments in an industrial finite elements program is described. ESA

N87-10900# Centre National d'Etudes Spatiales, Paris (France).
LAUNCHER-PAYLOAD DYNAMIC INTERACTION [INTERACTION DYNAMIQUE LANCEUR-CHARGE UTILE] c15
H. J.-P. Morand, B. Chemoul, and P. R. Bodagala *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 101-108 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Dynamic calculation methods and tools developed for the Ariane program are described. Two methods to reduce to a minimum the calculation of the dynamic load transmitted to the satellite are summarized: an equivalent load method compatible with the usual transient response algorithms, and a transfer function coupling method, used in a dynamic coupling analysis program. ESA

N87-10901# Rome Univ. (Italy).
COMPUTATIONAL METHODS IN ELASTIC PERIODIC STRUCTURES ANALYSES c39

Filippo Graziani and Silvano Sgubini *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 109-112 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A method for decomposing an eigenvalue problem of N-bays dimensions into N problems of 1-bay dimensions is indicated. The results provide a contribution to obtain a recursive relationship in evaluating the eigenvalue equation and in computing the eigenvalues for axisymmetric and linear periodic structures. ESA

N87-10902# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. of Aeroelasticity.
VERIFICATION OF THE MATHEMATICAL MODEL OF THE ARIANE 4 PAYLOAD FAIRING BY MEANS OF EXTENDED MODAL SURVEY TESTING c15
A. Bertram and P. Villalaz (Contraves Corp., Zurich, Switzerland) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 113-118 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Tests to gain insight into the geometric, nonlinear dynamic behavior of the Ariane half fairing were conducted. The static load test, and the modal survey tests in different predeformed states of the structure prove the important effect of geometric nonlinearities on the circumferential stiffness of the half shells. The results of the transient tests led to the use of the data obtained from the modal survey test on the undeformed structure as input for the finite element model adaptation. The reliability of the subsequent separation analyses were considerably improved by using the test data. ESA

N87-10903# Footscray Inst. of Tech. (Australia).
ON A SIMPLE VIBRATION CONTROL DESIGN FOR LARGE SPACE STRUCTURE MODELS WITH UNCERTAIN PARAMETERS
R. Licata *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 119-124 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The presence of unavoidable modeling errors and sizeable uncertainty in parameters of a reduced-order model of a large flexible space structure is addressed in relation to the controller design problem. Due mainly to limitations placed by on-board computers (which cause on-line adaptive or self-tuning control schemes to become unrealizable on flexible spacecraft) a controller design solution in the form of a simple to implement time-invariant feedback, obtained by considering constant and with known statistics the uncertain model parameters, is presented. The proposed stochastic optimal control scheme, more insensitive to parameter variation and spillover effects compared with that obtained by deterministic approach, may be used in the design of local or global controllers of a flexible spacecraft structure. ESA

N87-10904# London Univ. (England). Queen Mary Coll.
THE EFFECT OF THE NON-UNIFORM STRESS DISTRIBUTION IN THE BLANKETS OF SINGLE AND TWIN BOOM SOLAR ARRAY PANELS UPON THEIR MODAL CHARACTERISTICS c39
J. R. Wright *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 125-130 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The modal behavior of deployed flexible solar arrays of the single boom fold-out and twin boom roll-out types was studied with simple theoretical model configurations. The effect of the nonuniform stress distribution in the array blanket arising from flexible end members was investigated for out-of-plane/bending modes. It is found that the string-like modes important for control are hardly affected so a uniform tension analysis is adequate. However, other modes needed for response behavior are affected, particularly for the single boom array where buckling can occur. It is also found that bending stiffness in the blanket needs to be included to lead to a unique and complete set of array modes if uniform tension is assumed. ESA

N87-10905# Astron Research and Engineering, Santa Monica, Calif.
ACOUSTIC LOAD CONSIDERATIONS FOR SPACECRAFT STRUCTURES c16
J. F. Wilby and A. G. Piersol *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 133-143 Sponsored by NASA (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

An analytical model to predict the space averaged sound pressure levels in the payload bay of the Space Shuttle orbiter vehicle at lift-off was developed. A modified form of the model can also be used to predict vibration levels of the orbiter mid fuselage and to evaluate noise control concepts for the interior of the proposed Aft Cargo Carrier (ACC). The analytical model is presented and predicted payload bay sound pressure levels are compared with launch data for an empty bay. Estimated and measured sound pressure levels for regions above large diameter payloads are found to be significantly higher than those for the empty bay. The use of helium as a purge gas to reduce sound pressure levels in the ACC is proposed. ESA

N87-10906# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PREDICTION OF THE HIGH FREQUENCY RESPONSE OF SATELLITES TO DIFFUSE ACOUSTIC ENVIRONMENTS c39
B. Troclet, T. DangTrong, and C. Vidal *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 145-150 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The application of the LASCAR program to the analysis of the acoustical responses of the Ariane Sylda structure and the Arabsat satellite is described. The program, based on statistical analysis, provides the response of any aerospace structure including acoustical spaces and equipment boxes to a reverberant acoustic field. It is an improved version of the BRUIT program applied to the prediction of Ariane flight high frequency environments. The version is specially adapted to the response of a satellite submitted to a diffuse acoustic field. FORTRAN 77 was used as programming language. The LASCAR code is available on IBM and CDC computers. The predicted responses of structural configuration are compared to the measured responses. The program predictions show an excellent agreement with the measured response of complex structures and of equipment boxes attachment points. ESA

N87-10907# Centre National d'Etudes Spatiales, Toulouse (France).
PREDICTION AND CORRELATION OF STRUCTURAL RESPONSE IN ACOUSTIC CHAMBERS [PREVISION ET CORRELATION DE LA REPONSE DE STRUCTURES EN CHAMBRE ACOUSTIQUE] c39
F. Mercier and H. Defosse *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 151-156 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Vibro-acoustic prediction methods in random noise used for acoustic coupling analysis of large satellites are described. The first method is for low frequencies, using modal superposition. The second is a high frequency method using a statistical energy method via a comparison of calculations and tests of a honeycomb panel. Using both methods, the response throughout the entire acoustic frequency range can be calculated. ESA

N87-10908# Centre National d'Etudes Spatiales, Paris (France). Direction des Lanceurs.
LOW FREQUENCY RESPONSE OF AXISYMMETRIC STRUCTURES TO RANDOM NOISE [REPONSES BASEES DE STRUCTURES AXISYMMETRIQUES EN BRUIT DIFFUS] c39
G. Borello *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 157-162 In FRENCH (For

primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The axisymmetric properties of the Ariane 4 upper part are used to calculate the response of the equipment box to random noise. The response is compared to results of statistical energy analysis and of acoustic tests on Ariane. In order to improve predictions of the acoustic environment under the Ariane nose-cone at low frequencies, a method which extends the application limits of the SEA program towards lower frequencies is proposed. Test results show that utilization of the axisymmetric properties of the structure allows calculations to be extended upwards in frequency without losing accuracy and with moderate calculation costs. ESA

N87-10909# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACOUSTIC RADIATION AND INTERNAL DISSIPATION IN HONEYCOMB PANELS **c39**
K. T. Brown *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 163-168 Sponsored by British Aerospace, Filton, England (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A method of measuring internal loss factor and radiation loss factor directly on honeycomb panels in a reverberation room is described. The method has the advantage that measurements are made in a reverberation room with the same boundary conditions as the high intensity acoustic test. The resulting improvement in predicted levels is shown. ESA

N87-10910# Technische Hochschule, Aachen (West Germany). Inst. fuer Leichtbau.
TRANSIENT EXTERNAL LOADS OR INTERFACE FORCES RECONSTRUCTED FROM STRUCTURAL RESPONSE MEASUREMENTS **c39**
H. Oery, H. Glaser, and D. Holzdeppe *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 171-177 Sponsored by Deutsche Forschungsgemeinschaft and MBB GmbH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The procedure for the reconstruction of transient forcing functions based on measured structural responses during former flights is described, i.e., the inverse problem of the dynamic response is investigated. The method is developed on the basis of the combination and inversion of the phase-plane-method, which delivers modal responses and the Williams method, which separates the pure dynamic and the quasistatic parts of structural responses. Criteria influencing the reconstruction of the impulsive active load and its time-history are discussed. For a spacecraft transported by a launcher the interface motion time-history must be defined. ESA

N87-10911# Kassel Univ. (West Germany).
STRUCTURAL SYSTEM IDENTIFICATION USING SINGLE AND MULTIAXIAL VIBRATION TEST DATA **c39**
M. Link *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 179-184 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A method allowing for the verification of the mathematical model of a structure in terms of its modal data and in terms of its physical mass, stiffness, and damping matrix is presented. Single and multiaxial shaking table excitation and the effect of incomplete excitation and response data, i.e., the effect that only a limited number of modes may be excited are stressed. The numerical results of a study using a mathematical spacecraft model for simulating test data from shaking table excitation are presented. ESA

N87-10912# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec).
DEMONSTRATION OF MODAL SYNTHESIS ON AN EXPERIMENTAL STRUCTURE AND ITS APPLICATION TO LARGE SPACECRAFT **c39**
F. Charron, V. L. Jha, H. Lapierre, S. J. Sorocky, and F. R. Vigneron (Department of Communications, Ottawa, Ontario) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 185-190 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A substructural coupling method is demonstrated on an experimental structure. This method is used to compute the modal parameters of the structure. The substructures are defined using the modal parameters (natural frequencies, mode shapes and modal masses) measured from a modal survey or computed from a finite element model. Application of substructure coupling methods to large spacecraft is described. Results show inaccuracies (error in the natural frequency computation, inability to compute some modes) for the system results. ESA

N87-10913# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ANALYSIS/TEST CORRELATION AND UPDATE OF DYNAMIC MATHEMATICAL MODELS **c39**
Bernd Caesar *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 191-193 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Two methods of direct updating of mathematical models using modal test data are described. The minimum required constraints derived from eigendynamic and force equilibrium conditions are presented. The methods are used for generation of mass and stiffness matrices fitted exactly to test data. The applicability of the methods and improvements of test data which can be achieved with extensive analysis and test correlation on-line with the test performance are discussed. ESA

N87-10914# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. of Aeroelasticity.
APPLYING MODAL SURVEY TEST RESULTS FOR UPDATING DYNAMIC MATHEMATICAL MODELS OF SPACECRAFT STRUCTURES **c39**
H. Hueners *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 195-201 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Update of the dynamic model used for coupled analysis and for dynamic qualification of spacecraft is reviewed, emphasizing the main problem areas which must be taken into account when using measured modal data of a complex structure to update a given finite element model. Tools which may help correlate experimental and analytical modal data, and proposals for a systematic model updating strategy, to supersede the trial-and-error approach, are discussed. ESA

N87-10915# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
A REVIEW OF TIME DOMAIN MODAL TEST METHODS AND APPLICATIONS **c39**
Samir R. Ibrahim *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 205-211 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Time domain modal testing techniques based on direct use of a structure's free decay time response functions are reviewed. They are economical and powerful tools for in-space, or in-orbit, identification of space structures. Even though meritorious in laboratory controlled modal tests, these techniques possess unique and useful qualities when the only available responses are those obtained while the structure is in operation or use. Application to solar array orbital dynamics is described. ESA

N87-10916# British Aircraft Corp., Filton (England). Space and Communications Div.
THE DESIGN ANALYSIS AND VERIFICATION OF A SATEL-

LITE
J. Reynolds, J. Keefe, and J. Matthews *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 213-232 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The design, analysis, test, and verification of a satellite structure is presented. A large finite element model, constructed to produce good static stress recovery was reduced via the Guyan reduction to formulate a dynamic model. Similar models modified to represent the modal survey, and static test models utilizing the same element topology were used for final correlation. Simplified versions using the same element topology were used for parameter studies. The solar array aerodynamic inertia coupling within itself and with the structure is significant in changing in vacuo structure resonances. It is essential to include effects of the seismic mass to obtain acceptable dynamic correlation. ESA

N87-10917# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
INITIAL RESULTS FROM MULTIAXES TRANSIENT TESTING
K. Eckhardt *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 233-239 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The qualification testing of spacecraft structures is considered and a methodology in which the various verification steps merge to a series of closely coordinated experimental and analytical activities is proposed. The concept means introducing multiaxes transient testing using hydraulic vibration systems for earthquake simulation to replace conventional single-axes sine testing on electrodynamic shakers. The idea is to cope with large flexible spacecraft structures and to realize a more realistic simulation of loads by imposing transient base excitation with up to six degrees of freedom simultaneously in order to achieve the correct load vector (phase information). It is demonstrated that the required environment can be simulated with sufficient accuracy. Results of the comparison of detailed test responses with applicable responses measured in a shaker test using only axial transient input are presented. ESA

N87-10918# Centre National d'Etudes Spatiales, Paris (France).
FEASIBILITY STUDY OF A LAUNCHER VIBRATION ENVIRONMENT SIMULATOR [ETUDE DE FAISABILITE D'UN SIMULATEUR D'AMBIANCE VIBRATOIRE DE LANCEUR] c14
H. J. P. Morand, B. Chemoul, F. Celle, J. P. Gauthier, F. Rouvrais (Intespace, Toulouse, France), and S. Michel *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 241-245 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A launcher mechanical environment simulator based on a closed loop technique is presented. It reproduces the dynamics of a launcher-satellite system excited by a transient input. The algorithm uses measurements, and an internal model of the test structure in real time. A real time identification process using the measurements enables a simple model of the satellite to be redefined. This model is coherent with the level of excitation and modifies the reference model and the internal model. ESA

N87-10919# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. of Aeroelasticity.
EXPERIENCE ON THE OLYMPUS MODAL SURVEY TEST
M. Knorr and A. Bertram *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 247-252 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A modal survey test (MST) on two configurations of the large structure test model of the Olympus communications satellite is described: A configuration with the main tanks 2/3 full, the second with empty tanks. The complete MSTs were finished within 4 weeks, including installation and strip down of the test equipment. The spacecraft was mounted on a 40 t seismic block. The satellite is characterized by large dimensions, mass, and complexity. This made it necessary to install a number of exciters and accelerometers at inaccessible structural points several months prior to testing. The test was performed using a computer-supported classical phase resonance method. The day-by-day data transfer via data tape enabled the customer to correlate measured and calculated eigenmodes immediately and to perform orthogonality checks at the end of a working day. ESA

N87-10920# National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
STRUCTURAL CONCEPT OF JAPANESE ADVANCED GEOSTATIONARY SPACECRAFT
Hidehiko Mitsuma *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 255-260 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A structural concept for a 2000 kg geostationary spacecraft bus for communication and broadcasting satellites was derived. Design trade-off results, basic configurations, and structures obtained from the conceptual design study are presented. Structural component development and test planning are discussed. ESA

N87-10921# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Space Div.
RELIABILITY AND ECONOMICS OF SPACECRAFT STRUCTURE DEVELOPMENT
M. P. Nieuwenhuizen *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 261-269 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Changes to traditional spacecraft design and development plans are suggested. A full scale hardware structure model, which is nearly identical to the flight model, is deleted. A simple hardware model is used at the beginning of the project to establish load path and resonance frequencies and supply design information. The protoflight or flig ht model (PFM, FM) is designed such that a simple static test and vibration test can be performed. Verification calculation were performed after PFM and FM testing. The static test was simplified by testing only the global load. ESA

N87-10922# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACECRAFT LOAD, DESIGN AND TEST PHILOSOPHIES c38
Ben K. Wada *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 271-276 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The development of spacecraft loads, design and test philosophies at the Jet Propulsion Laboratory (JPL) during the past 25 years is presented. Examples from the JPL's Viking, Voyager and Galileo spacecraft are used to explain the changes in philosophy necessary to meet the program requirements with a reduction in cost and schedule. Approaches to validate mathematical models of large structures which can't be ground tested as an overall system because of size and/or adverse effects of terrestrial conditions such as gravity are presented. ESA

N87-10923# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF DEPLOYABLE TRUSS CONCEPT FOR SPACE STATION
H. S. Greenberg (Rockwell International Corp., Downey, Calif.) and E. E. Engler *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 277-282 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A single-fold, automatically deployable and retractable, square-shaped truss concept that is a candidate for the strongback of NASA's Space Station was developed. Compact stowage within a square-shaped housing is achieved by using folded longerons and telescoping diagonal members. Deployment or retraction is accomplished, bay by bay, in a controlled manner with root strength

maintained at all times. Control is accomplished by motor-driven jack-screws operated by a controller. Power, data, and fluid utility lines can be integrated onto trays that unfold with the truss. To verify performance a kinematically representative ground test article version is used. ESA

N87-10924# Saab-Scania, Linkoping (Sweden).
TELE-X ANTENNA MODULE STRUCTURE QUALIFICATION PROGRAM
Torbjoern Andersson *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 283-288 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The qualification program for the TELE-X Spacecraft Antenna Module Structure is presented. The CFRP structure is adapted to a Cassegrain system with extreme thermal stability requirements. Requirements constraining the design and the qualification program to verify the structure ability to meet these requirements are described. Analysis models used and experience from test predictions and model correlations are presented. ESA

N87-10925# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Group.
INFLUENCE OF FIBER ORIENTATION AND BOUNDARY CONDITIONS ON THE DYNAMIC BEHAVIOR OF A CYLINDRICALLY TELESCOPING SOLAR ARRAY (INTELSAT 6) c44
E. D. Sach, H. J. Huettmann, and E. Fritsche *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 289-292 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

To meet the strong frequency requirements in stowed configuration of the INTELSAT 6 solar array (2 central telescoping cylinders in sandwich design, the face sheets of which are made of aramid fiber fabric and carbon fiber fabric) analyses were performed to show the influence of fiber orientations, number of layers and stiffener rings and boundary conditions on the dynamic behavior. The investigations show that each reinforcement measure is effective only in a very limited range. To fulfill the frequency requirement with a minimum structural mass, a combination of several reinforcements is necessary. ESA

N87-10926# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOADS ANALYSIS FOR THE GALILEO SPACECRAFT c39
Marc Trubert *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 293-298 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The loads analysis for the design of the Galileo structure was done by combining the transient analysis method with methods aimed at reducing cost and schedule impact while increasing confidence in the estimation of the loads. The preliminary sizing was done by the mass acceleration curve. The loads iterations were done by the generalized shock spectra method. Only a few critical subsystems required a coupled transient analysis to show positive margins. Dynamic coupling between the launch vehicle and the spacecraft was done by analytically removing and adding a spacecraft to a given launch vehicle at the modal level, without re-solving the eigenvalue problem. The modal response resulting from the dynamic coupling between the launch vehicle and the spacecraft was used only for the 28 Galileo modes below 40 Hz. In the absence of definition of the Shuttle/Centaur model and the forcing functions above 40 Hz, the mass acceleration curve was used to generate modal bounds between 40 and 80 Hz. ESA

N87-10927# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
DEVELOPMENT OF A LIGHTENED STRUCTURE FOR THE GSR3 SOLAR GENERATOR [DEVELOPPEMENT D'UNE STRUCTURE ALLEGEE DE GENERATEUR SOLAIRE GSR3]
A. Plagne and J. P. Reau *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 299-304 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Weight reduction techniques employed in the GSR3 solar generator (35W/kg end of life) are described. The surface mass of the structure is 900 to 1050 g/sqm depending on the degree of optimization of stacking points. The structure is highly versatile, and can be used fully or partly deployed. Carbon fiber composite was chosen to meet weight and sizing constraints. ESA

N87-10928# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Space Div.
ENGINEERING AND SOFTWARE INTERFACING FOR THERMAL, STRUCTURAL AND ATTITUDE CONTROL RELATED WITH SPACECRAFT
J. J. Wijker, H. Geyselaers, and A. C. M. vanSwieten *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 305-313 (For primary document see N87-10886 02-18)
(Contract ESTEC-5158/82-NL-PB(SC))
Avail: NTIS HC A19/MF A01

The engineering and software interfaces between the finite element package ASKA, the dynamic and control analysis package DCAP, and the thermal analysis program SINDA are presented. The engineering background of interface programs IFDCAP and SINAS is discussed. ESA

N87-10929# MATRA Service Aerodynamique, Le Chesnay (France). Mechanical Engineering Dept.
STRUCTURAL DEVELOPMENT OF THE TELESCOPE STRUCTURE OF THE HIPPARCOS SATELLITE PAYLOAD c24
J. P. Allard *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 315-319 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The structural development of the graphite/epoxy telescope structure of the HIPPARCOS Satellite payload is presented. The structure is made of carbon fiber reinforced plastic surrounded by a computer controlled thermal enclosure. Ultrahigh modulus carbon fiber GY70 with the epoxy resin fiberite 934 are used. Internal baffles minimize stray light on the focal plane baffle. In order not to modify the reflective surface of the mirrors under mechanical loads or variation of temperature of telescope structure or mirrors, the mirrors are individually attached on mirror barrels. For stability requirements, the opto-electronic detection equipments are mounted on a very rigid dismountable focal plane assembly platform. ESA

N87-10930# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mathematics.
CRITICAL ELEMENT CONCEPTS FOR COMPOSITE STRUCTURES c39
Kenneth L. Reifsnider *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 323-328 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A critical element model approach to designing composite structures, e.g., for spacecraft, space platforms, launch vehicles and related equipment, is proposed. The modeling scheme combines mechanistic modeling of internal stress redistributions caused by damage with phenomenological (continuum) representations of property changes in critical elements to predict residual strength as a function of several types of loading. It utilizes a continuous summation scheme which is amenable to the automated computation of residual strength as a continuous function under cycle-dependent and time-dependent load environments which vary arbitrarily with time. The approach is successful for a wide variety of circumstances involving uniform stress fields. ESA

N87-10931# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
GRAZING-INCIDENCE MIRROR CARRIERS MADE OF CARBON FIBER REINFORCED EPOXY MATRIX SYSTEM c24
J. Klug *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 329-334 Sponsored by ESA

(For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

A manufacturing technique study was carried out for the low energy telescopes for the X-ray Multi Mirror mission (XMM). X-ray parabolic mirror carriers were fabricated, onto which the reflecting X-ray surface was transferred by the replica method as developed for EXOSAT. Instead of using beryllium carriers, carbon fiber reinforced epoxy (CFRE) carriers were investigated. These would be of great advantage for the series production envisaged for the XMM mission. The theoretical investigations concerning the definition of laminate lay-ups of characteristics sufficient to the actual requirements were finished successfully. The diversity of laminate lay-up can be adapted to modified future needs. The geometrical quality of the CFRE carrier is as good as that of the filament winding and the machining jig. ESA

N87-10932# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
THE K1-K2 INTERACTION FOR MATRIX SPLITTING IN UNIDIRECTIONAL LAMINATES OF CARBON FIBER REINFORCED EPOXY c24
H. Eggers and L. Kirschke *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 335-340 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Rectangular side-notched specimens of multilayered unidirectional off-axis laminates of carbon-fiber reinforced epoxy T300-914C were tested for matrix splitting. For quasi-static loads the notch opening displacements, specimen elongations and crack lengths were measured. A finite element technique combined with theoretical formulas for the straining of the material at the crack tip were used. Cracks always develop parallel to the fibers. Misaligned fibers or layers act as crack stoppers. In thin laminates the cracks initiate earlier but propagate with less speed than in thick ones. The energy release rate is not a material constant, suitable to describe the crack propagation uniquely. Cracks initiate by a critical combination of the stress intensity factors. Crack propagation depends predominatly on the crack opening mode 1 and very little on the shear mode 2. ESA

N87-10933# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Fachbereich Technische Mechanik.
DEBONDING ANALYSIS OF THERMALLY STRESSED FIBER-REINFORCED COMPOSITE MATERIALS c24
F.-G. Buchholz and K.-H. Senger *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 341-346 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The effects of two ways of micromechanical modeling on the debonding analysis of thermally stressed unidirectionally fiber-reinforced composite materials are investigated. The models are a simple single circular unit cell and a more complex hexagonal unit cell embedded in the surrounding compound, as different orders of approximation to a real composite material. Correlation between the thermally induced elastic strain energy and the energy release rate of a curved interface crack, debonding an individual fiber from the adherent matrix material in both models is studied. The influence of increasing fiber volume fractions on the debonding behavior is assessed. Results show that the elastic strain energies induced in the models nearly coincide, although they differ distinctly in their geometrical contours and boundary conditions. For fiber volume fractions $< 10\%$ it is shown that only the more complex model can deliver relevant results for the thermally induced plane strain debonding process in a real material. ESA

N87-10934# Societe Nationale Industrielle Aerospatiale, Cannes (France).
SPACE TECHNOLOGIES AND MATERIALS: A LOOK BACK AND FUTURE PERSPECTIVES [TECHNOLOGIES ET MATERIAUX SPATIAUX: RETROSPECTIVE ET PERSPECTIVES D'AVENIR] c23
J. A. Massoni and J. L. Cecconi *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 347-351 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

The evolution in satellite construction materials from aluminum alloys to carbon-resin structures is discussed. Future applications of metal matrix composites, aluminum-lithium composites, and silicon carbide reinforced aluminum composites are examined. ESA

N87-10935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
PERFORMANCE CHARACTERISTICS OF COMPOSITE MATERIALS c24
H. W. Bergmann, M. Gaedke, and H. C. Goetting *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 353-359 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

Allowable stresses for multidirectional laminates with arbitrary stacking orders are predicted analytically using the characteristics of unidirectional plies established by test. The forecast properties for static tension loading include first ply failure and ultimate strength and take into account the state of prestress induced by widely varying environmental conditions. In laminates mechanically fatigued at $R = 0.1$ the influences of temperature and moisture are shown to be moderate. In matrix-controlled laminates, elevated temperature and moisture saturation degrade the fatigue strength, while in fiber-controlled laminates the presence of moisture tends to be beneficial. In multidirectional laminates the slopes of the delta-N curves are essentially unaffected in various hot-wet conditions. Matrix-controlled laminates subjected to severe thermal cycling exhibit strength and stiffness degradations depending on the brittleness of the matrix systems. Moderate to severe matrix cracking is observed. ESA

N87-10936# Engineering System International, Rungis (France).
NUMERICAL CALCULATION OF DAMAGE TOLERANCE AND ADMISSABLE STRESS IN COMPONENTS MADE OF COMPOSITE MATERIALS USING THE PAM-FISS/BI-PHASE MATERIAL MODEL c24
E. Haug, P. Dowlatyari, and A. deRouvray *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 361-371 Sponsored by ESA (For primary document see N87-10886 02-18)
(Contract DRET-SDR-G8)
Avail: NTIS HC A19/MF A01

The tensile failure analysis of composites made of straight, long, fibers (carbon-epoxy) is described. The model is used to simulate matrix cracks via the fracture mechanics features built into the PAM-FISS computer code (matrix splitting, delamination, and ubiquitous matrix cracks). Fiber rupture is simulated in a double edge notched tensile multilayered test piece, after extensive matrix cracking occurs. The failure analysis of carbon-epoxy fabric test pieces, loaded in compression and in bending, where the nonlinear stress analysis features of the PAM-FISS code were used is outlined. The same material model (elastoplastic matrix/brittle fibers) as for the analysis of straight fiber composites is used. Fiber buckling in the compression zones, predicted as a consequence of prior matrix plastification, and fiber rupture in the tensile zones (bending test), lead to a correct prediction of the overall test piece failure. ESA

N87-10937# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
INVESTIGATION OF THE COUPLING OF THE HERMES VEHICLE TO THE ARIANE 5 LAUNCHER [ETUDE DE L'ACCROCHAGE DU VEHICULE HERMES SUR LE LANCEUR ARIANE 5] c15
M. Agrain *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 375-380 In FRENCH (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

An interface for the Ariane-Hermes space shuttle system is proposed. A structure modifies the noncircular shape of the shuttle to enable it to meet constraints imposed by the multimission role of Ariane. This structure, a shell, is more effective as part of the glider rather than as part of the adapter, which is expendable. The structure is made of self stiffened carbon. The adapter is a simple tube. ESA

N87-10938# Societe Bertin et Cie, Plaisir (France).

DYNAMICS OF FLEXIBLE MECHANISMS [DYNAMIQUE DE MECANISMES FLEXIBLES] c39

G. Gallay, F. Girard, and J. M. Auclair *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 381-386 In FRENCH (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

A method for the automatic generation of the equations of motion of complex flexible mechanical systems such as large space structures is presented. The equations are derived using the method of virtual work of Kane (1901). The rigid body kinematics treatment uses relative coordinates. A model synthesis method is added to handle the problem of a deformable solid body. The method minimizes the number of equations, while being able to cope with complex topologies (closed chains). ESA

N87-10939# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Group.

ANALYTICAL PREDICTION OF CYLINDRICAL AND CASSINI-SHAPED SHELL CONTOURS AFTER PLASTIC STRETCHING c39

D. Hummel, J. Franz, and E. D. Sach *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 387-391 (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

Analysis of the aluminum pressure vessel of the anticoincidence subsystem of the EGRET instrument of the Gamma Ray Observatory satellite is described. The pressure vessel consists of a cylindrical shell (diameter 1463 (-1.0) mm, height 956.6 + or - 0.1 mm) with bottom ring and a Cassini-shaped dome (tolerance of Cassini contour -0.5 mm, height 552.5 + or - 1.5 mm) on its top. As no welding was permitted for this vessel it was spin formed from a flat circular plate (diameter 2000 mm, thickness 10 mm) and subsequently heat treated. After this procedure plastic oversize stretching by internal pressurizing the vessel and pressing it into a mold of concrete was required to remove bumps occurring during heat treatment and to bring the vessel into its final shape. The plastic stretching and spring-back behavior of the pressure vessel was analyzed with the NASTRAN finite element program using GAP-elements. The predictions are very satisfactory. ESA

N87-10940# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).

A METHOD OF STUDYING THE BEHAVIOR OF COMPOSITE MATERIALS IN SIMULATED SPACE ENVIRONMENTS [MOYEN D'ETUDE DU COMPORTEMENT EN AMBIANCE SPATIALE SIMULEE DE MATERIAUX COMPOSITES] c24

F. Albugues, P. Plotard, M. F. Gomez (Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France), A. Paillous, and M. D. Judd (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 393-397 In FRENCH (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

A method to evaluate the mechanical properties of composite spacecraft structural materials in simulated space vacuum, radiation, and thermal conditions was developed. It can irradiate in secondary vacuum a test batch of which a part is measured in situ and the rest afterwards. Different stages of aging due to UV and electron irradiation can be accounted for. ESA

N87-10941# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).

KINEMATIC ANALYSIS OF A LARGE DEPLOYABLE TRUSS ANTENNA

G. Brazzini, Y. Broustet, C. Garnier, and P. Picard *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 399-405 (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

A development program for the kinematic qualification of a large deployable spacecraft reflector is presented. The program relies upon ground deployment tests and numerical simulations. A general calculation code ADAMS was used. Satisfactory verifications for the elementary unit were completed. In-orbit predictions demonstrate concept validity and clarify the critical points with regard to kinematics. ESA

N87-10942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

OPTIMIZATION OF AXIALLY COMPRESSED CFRP CYLINDERS c39

R. Zimmermann *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 407-412 (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

The mass minimization of axially compressed CFRP cylindrical shells which may fail due to buckling or loss of material strength, was replaced by a sequence of buckling load maximizations. The layer orientations are used as design variables to be changed both continously and discretely. The results show that the optimal orientations are practically independent of the parameters describing the cylinder. Further results are of use to gain experience about the properties of optimal structures made of fiber composites. They answer questions about the sensitivity of optimal fiber orientations to changes of ply stiffness, about the loss arising from discrete variation of the orientations compared with continuous variation, and about the gain from optimization. ESA

N87-10943# British Aircraft Corp., Filton (England).

SPACECRAFT STRUCTURAL ACOUSTICS: PROGRESS IN VIBRATION LEVEL PREDICTION c39

P. J. Williams, R. J. Cummins, and D. C. G. Eaton (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 415-428 (For primary document see N87-10886 02-18)

Avail: NTIS HC A19/MF A01

Research to provide techniques compatible with engineering requirements for the prediction of launch induced high frequency vibration regimes in spacecraft is reviewed. Better understanding of response behavior leads to the analysis of less complex theoretical models and the specification of far simpler test configurations. Most of the work is based on statistical energy analysis, although scaling procedures and normal mode analyses are considered. ESA

N87-10944*# Energy Science Labs., Inc., San Diego, Calif.

GUIDEBOOK FOR ANALYSIS OF TETHER APPLICATIONS Final Report

Joseph A. Carroll Feb. 1985 47 p

(Contract NAS8-35499)

(NASA-CR-178903; NAS 1.26:178903) Avail: NTIS HC A03/MF A01 CSCL 22A

This guidebook is intended as a tool to facilitate initial analyses of proposed tether applications in space. Topics disscussed include: orbit and orbit transfer equations; orbital perturbations; aerodynamic drag; thermal balance; micrometeoroids; gravity gradient effects; tether control strategies; momentum transfer; orbit transfer by tethered release/rendezvous; impact hazards for tethers; electrodynamic tether principles; and electrodynamic libration control issues. B.G.

N87-10945*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCEEDINGS OF THE 2ND ANNUAL SCOLE WORKSHOP
Lawrence W. Taylor, Jr., comp. Oct. 1986 268 p Workshop held in Hampton, Va., 9-10 Dec. 1985
(NASA-TM-89048; NAS 1.15:89048) Avail: NTIS HC A12/MF A01 CSCL 22B

Proceedings of the Second Annual Spacecraft Control Laboratory Experiment (SCOLE) Workshop held at the NASA Langley Research Center, Hampton, Va., December 9 to 10, 1985 are presented. Author

N87-10946*# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
ENVIRONMENTALLY-INDUCED DISCHARGE TRANSIENT COUPLING TO SPACECRAFT Final Report
R. Viswanathan, G. Barbay, and N. J. Stevens May 1985 92 p
(Contract NAS3-23869)
(NASA-CR-174922; NAS 1.26:174922) Avail: NTIS HC A05/MF A01 CSCL 22B

The Hughes SCREENS (Space Craft Response to Environments of Space) technique was applied to generic spin and 3-axis stabilized spacecraft models. It involved the NASCAP modeling for surface charging and lumped element modeling for transients coupling into a spacecraft. A differential voltage between antenna and spun shelf of approx. 400 V and current of 12 A resulted from discharge at antenna for the spinner and approx. 3 kv and 0.3 A from a discharge at solar panels for the 3-axis stabilized Spacecraft. A typical interface circuit response was analyzed to show that the transients would couple into the Spacecraft System through ground points, which are most vulnerable. A compilation and review was performed on 15 years of available data from electron and ion current collection phenomena. Empirical models were developed to match data and compared with flight data of Pix-1 and Pix-2 mission. It was found that large space power systems would float negative and discharge if operated at or above 300 V. Several recommendations are given to improve the models and to apply them to large space systems. Author

N87-10947# Oak Ridge National Lab., Tenn.
PROTECTION OF SPACECRAFT FROM METEOROIDS AND ORBITAL DEBRIS
A. P. Fraas Mar. 1986 66 p
(Contract DE-AC05-84OR-21400)
(DE86-009996; ORNL/TM-9904) Avail: NTIS HC A04/MF A01

This report presents a review of information on the incidence of meteoroids and solid debris in orbital space, the damaging effects of these materials, and the principles that may be used to design protective shields for orbiting spacecraft. The report was prepared as part of a current Oak Ridge National Laboratory effort to develop and evaluate conceptual designs of space power systems. DOE

N87-10948# ANT Nachrichtentechnik, Backnang (West Germany). Fachbereich Raumfahrt.
DEVELOPMENT OF EQUIPMENT FOR THE 20/30 GHz PAYLOAD OF A SATELLITE FOR PROPAGATION AND TRANSMISSION EXPERIMENTS Final Report, Jan. 1985
Dietmar Rosowsky Bonn, West Germany BMFT Dec. 1985 105 p In GERMAN; ENGLISH summary Sponsored by BMFT (BMFT-FB-W-85-035; ISSN-0170-1339; ETN-86-97848) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22

Microwave bandpass filters in the 20/30 GHz frequency range were developed. These are TE011 and TE112-mode filters with Tschebyscheff and elliptic function characteristics. Test results obtained on a 30 GHz diplexer are reported. ESA

N87-10949# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Rech. en Technol. Spatiale.
DESIGN IMPROVEMENT AND RADIATION, CONTAMINATION TESTS. PRESTUDY 1: ULTRAVIOLET RADIATION ACCELERATION, VOLUME 1 Final Report [AMELIORATION ET ESSAIS: CONTAMINATION PLUS IRRADIATION. PREETUDE 1: ACCELERATION DES IRRADIATIONS ULTRAVIOLETTES. TOME 1: ESSAIS ET CONCLUSIONS]
J. Marco, Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris ESA Dec. 1985 92 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-1; CERT-419300/PR1/T01-DERTS; ESA-CR(P)-2227-Vol-1; ETN-86-98105) Avail: NTIS HC A05/MF A01

The influence of increasing the ultraviolet radiation intensity on the degradation of satellite thermal control surface coatings is studied. Several materials were insolated for the equivalent of 1000 solar hours with intensities 2 to 8 times stronger than the radiation of the Sun, at wavelengths under 400 nm. Visible light and infrared radiation were filtered out. The materials include white paints, aluminized kapton, black paints, aluminum paints, and silver coatings. The results are extremely variable, the absorption spectra vary with the degradation of the coating, and the degradation at the higher intensities is not always greater than at relatively low intensities. ESA

N87-10950# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Rech. en Technol. Spatiale.
DESIGN IMPROVEMENT AND RADIATION CONTAMINATION TESTS. PRESTUDY 1: ULTRAVIOLET RADIATION ACCELERATION. VOLUME 2: APPENDIX, DETAILED RESULTS Final Report [AMELIORATION ET ESSAIS: CONTAMINATION PLUS IRRADIATION. PREETUDE 1: ACCELERATION DES IRRADIATIONS ULTRAVIOLETTES. TOME 2: ANNEXES, RESULTATS DETAILLES]
J. Marco, Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris ESA Dec. 1985 200 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-2; ESA-CR(P)-2227-Vol-2; ETN-86-98106) Avail: NTIS HC A09/MF A01

The influence of increasing ultraviolet radiation intensity on the degradation of satellite thermal control surface coatings is studied. Several materials were insolated for the equivalent of 1000 hr with intensities 2 to 8 times stronger than the radiation of the Sun, at wavelengths under 400 nm. Visible light and infrared were filtered out. The materials included white paints, aluminized Kepton, black paints, alinum paints and silver coatings. The results are extremely variable, the absorption spectra vary with the degradation of the coating, and the degradation at the higher intensities is not always greater than at relatively low intensities. ESA

N87-10951# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Rech. en Technol. Spatiale.
IMPROVING THE IRRADIATION PLUS CONTAMINATION TESTS. PRESTUDY 2: SUCCESSIVE IRRADIATIONS AND SYNERGICS. VOLUME 1: TESTS AND CONCLUSIONS Final Report [AMELIORATION ET ESSAIS: CONTAMINATION PLUS IRRADIATION. PREETUDE 2: IRRADIATIONS SUCCESSIVES ET SYNERGIE. TOME 1: ESSAIS ET CONCLUSIONS]
J. Marco, Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris ESA Dec. 1985 65 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-3; CERT-419300/PR2/T01-DERTS; ESA-CR(P)-2227-Vol-3; ETN-86-98107) Avail: NTIS HC A04/MF A01

A simulation of 1 yr exposure to a geosynchronous orbit space environment was carried out. Ultraviolet radiation, protons, and electrons acted on surface coatings used on satellite thermal control equipment. The low sensitivity of the optical measurement prevents quantitative comparison. Nevertheless, observations regarding degradable materials are included. ESA

N87-10952# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Rech. en Technol. Spatiale.
IMPROVING RADIATION PLUS CONTAMINATION TESTS. PRESTUDY 2: SUCCESSIVE IRRADIATIONS AND SYNERGICS. VOLUME 2: ANNEXES. ANNEX 1: DETAILED RESULTS. ANNEX 2: CONTROL AND IMPROVEMENT OF OPTICAL MEASUREMENTS Final Report [AMELIORATION ET ESSAIS: CONTAMINATION PLUS IRRADIATION. PREETUDE 2: IRRADIATIONS SUCCESSIVES ET SYNERGIE. TOME 2: ANNEXES. ANNEXE 1: RESULTATS DETAILLES. ANNEXE 2: CONTROLE ET AMELIORATION DES MESURES OPTIQUES]
J. Marco, Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris ESA Dec. 1985 63 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-4; ESA-CR(P)-2227-Vol-4; ETN-86-98108) Avail: NTIS HC A04/MF A01

A simulation of 1 yr exposure to a geosynchronous orbit space environment was carried out. Ultraviolet radiation, protons and electrons were used on surface coatings employed on satellite thermal control equipment. The low sensitivity of the optical measurements precludes a quantitative comparison. Nevertheless, observations regarding degradable materials are included. ESA

N87-10953# MATRA Espace, Toulouse (France).
ELECTROSTATIC DISCHARGE EFFECTS ON SATELLITE ELECTRONIC DEVICES Final Report [EFFECTS DES DECHARGES ELECTROSTATIQUES SUR LES ELECTRONIQUES SATELLITES]
L. Brett, J. P. Estienne, J. G. Ferrante, M. Frezet, J. P. Granger, P. Noel, G. Labaune, L. Levy, and J. P. Catani Paris ESA 14 Jan. 1986 151 p In FRENCH
(Contract ESTEC-1-1553/83-NL-BI)
(Matra-CMT-138-JPG-078-85; ESA-CR(P)-2229; ETN-86-98110) Avail: NTIS HC A08/MF A01

The coupling mechanisms between an electrostatic discharge produced anywhere on the surface of a satellite and the electronic circuits contained in the satellite are analyzed and quantified. The study covers aspects of discharge physics and electromagnetic coupling including the impedance effect and its influence on scale laws, the incidence of the proportion between total ejected charge and satellite capacity, the concept of saturation current, and the modification of Bethe's model of electromagnetic coupling through satellite windows. Computer programs utilizing a model library to simulate and quantify electrostatic coupling are presented. ESA

N87-10954# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Rech. en Technol. Spatiales.
IMPROVING RADIATION/CONTAMINATION TESTS Final Report [AMELIORATION DES ESSAIS: CONTAMINATION PLUS IRRADIATION]
J. Marco and A. Paillous Paris ESA Jul. 1985 95 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-419300/1-DERTS; ESA-CR(P)-2245; ETN-86-98123; PS-4) Avail: NTIS HC A05/MF A01

The characteristics of optical fibers in the wavelengths from 300 to 2500 nm are studied in order to define an improved optical spectral measuring instrument able to determine in situ the reflection factor of satellite coatings. The measuring system would have fixed samples and movable detector (optical fibers) in a high vacuum environment. A detailed study of optical fiber bundles is included. Energy balance of different systems using fibers is compared. Possible solutions are examined concluding that improved systems based on the use of optical fibers are feasible. ESA

N87-10955# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherche de Geodesie Spatiale.
STUDY OF THE PERFORMANCES OF SEASAT SATELLITE OVER ICE AND SEA ICE [ETUDE DU FONCTIONNEMENT DU SATELLITE SEASAT SUR LES GLACES ET GLACES DE MER]
C. Schgounn Paris ESA Nov. 1982 39 p In FRENCH
(Contract ESA-4751/81-F-DD-(SC))
(CNES-CS/MM/82/117/CT/GRGS; ESA-CR(P)-2248; ETN-86-98125) Avail: NTIS HC A03/MF A01

The conditions of utilization of an altimetric radar included in SEASAT satellite to study sea ice and the topography of the polar caps are studied. The Oakhanger raw data, produced at a rate of 10 points/sec are analyzed and the specific responses of ice and snow regions are compared. The physical properties of water, snow, ice, and sea ice are studied to determine the parameters affecting the return signal and to estimate the contribution of the volume echo of each to the signal power. It is shown that the SEASAT altimeter differentiates the snow of the polar caps and the sea ice. It allows the determination of the limits of the evolution of the sea ice, but it is not adapted to follow the variations of the surface of the snowpack. ESA

N87-10956# Marconi Space Systems Ltd., Portsmouth (England).
MODERN CONTROL OF LARGE FLEXIBLE SPACECRAFT, ESA ASTP STUDY Final Report
Paris ESA May 1985 272 p
(Contracts ESA-5664/83-NL-BI; ESTEC-5352/83-NL-HP(SC))
(BL-6206-Issue-2; ESA-CR(P)-2197; ETN-86-98083) Avail: NTIS HC A12/MF A01

Stability control of large flexible spacecraft using bang-bang nonlinear control based on Sturm's theorem was investigated. A canonical model for preliminary tuning of the Sturm control law was derived. The damping matrix for the control law was studied. Use with one and two flexure modes per array axis; state estimation; stationkeeping maneuver responses; effect of parameter mismatches; and effect of mode spillover were assessed. Comparisons with other techniques show that the Sturm controller is superior, particularly with respect to ability to reject orbital correction disturbance. ESA

N87-10957# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.
LARGE FLEXIBLE SPACE STRUCTURES: SOME SIMPLE MODELS
J. Bontsema 1986 27 p
(TW-269; B8666169; ETN-86-98503) Avail: NTIS HC A03/MF A01

Simple models of large flexible space structures are used to study the effect of flexibility and damping. The models are a one dimensional flexible beam (Euler-Bernouilli) and two flexible beams connected through a central disk, where for simplicity it is assumed that the thickness of the disk in the direction of the beams is zero. Partial differential equations are derived for these structures and it is proved that the equations are well posed. Equations for the eigenfrequencies and eigenmodes of the structures are given and the controls and observations are discussed. As an example for finite dimensional control design the method of Curtain (1983) is discussed. ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N87-10958# Plessey Research (Caswell) Ltd., Towcester (England). Allan Clark Research Center.
SUB-MILLIMETRE (FAR-IR) HETERODYNE SPECTROMETER ASSEMBLY Final Report
C. J. Groves-Kirby Paris ESA Jun. 1984 112 p
(Contract ESA-4548/80-NL-HP)
(CD.6500689; ESA-CR(P)-2198; ETN-86-98084) Avail: NTIS HC A06/MF A01

The implementation of the IF amplifier, down converter, and Bragg cell processor in a 300 to 500 GHz heterodyne spectrometer assembly, incorporating a 1.3 GHz Bragg-cell back-end

spectrum analyzer with 3.7 to 4.2 GHZ input are described. Fabrication of the Bragg cells; tests on optical and radio frequency components; and output array tests are summarized. Commissioning test results are satisfactory. ESA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N87-10959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF ADVANCED PROPULSION FOR SPACE BASED ORBITAL TRANSFER VEHICLE
Larry P. Cooper and Dean D. Scheer 1986 32 p Presented at the 37th Congress of the International Astronautical Federation, Innsbruck, Austria, 4-11 Oct. 1986
(NASA-TM-88848; E-3238; NAS 1.15:88848; IAF-86-183) Avail: NTIS HC A03/MF A01 CSCL 21H

A new Orbital Transfer Vehicle (OTV) propulsion system will be required to meet the needs of space missions beyond the mid-1990's. As envisioned, the advanced OTV will be used in conjunction with Earth-to-orbit vehicles, Space Station, and Orbit Maneuvering Vehicle. The OTV will transfer men, large space structures, and conventional payloads between low Earth and higher energy orbits. Space probes carried by the OTV will continue the exploration of the solar system. When lunar bases are established, the OTV will be their transportation link to Earth. NASA is currently funding the development of technology for advanced propulsion concepts for future Orbital Transfer Vehicles. Progress in key areas during 1986 is presented. Author

N87-10960*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION-RESISTANT REFLECTIVE SURFACES FOR SOLAR DYNAMIC POWER GENERATION IN NEAR EARTH ORBIT
Daniel A. Gulino, Robert A. Egger (Cleveland State Univ., Ohio), and William F. Banholzer (General Electric Co., Schenectady, N. Y.) 1986 16 p Presented at the 33rd National Symposium of the National Vacuum Society, Baltimore, Md., 27-31 Oct. 1986
(NASA-TM-88865; E-3268; NAS 1.15:88865) Avail: NTIS HC A02/MF A01 CSCL 10B

Reflective surfaces for space station power generation systems are required to withstand the atomic oxygen-dominated environment of near Earth orbit. Thin films of platinum and rhodium, which are corrosion resistant reflective metals, have been deposited by ion beam sputter deposition onto various substrate materials. Solar reflectances were then measured as a function of time of exposure to a RF-generated air plasma. Similarly, various protective coating materials, including MgF2, SiO2, Al2O3, and Si3N4, were deposited onto silver-coated substrates and then exposed to the plasma. Analysis of the films both before and after exposure by both ESCA and Auger spectroscopy was also performed. The results indicate that Pt and Rh do not suffer any loss in reflectance over the duration of the tests. Also, each of the coating materials survived the plasma environment. The ESCA and Auger analyses are discussed as well. Author

N87-10961# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
EXPERIMENTAL VERIFICATION OF ROCKET EXHAUST PLUMES AND IMPINGEMENT EFFECTS ON SPACECRAFT SURFACES Executive Summary
C. Dankert, G. Dettleff, G. Koppenwallner, and H. Legge Paris ESA Aug. 1985 70 p
(Contract ESA-5194/82-NL-PB(SC))
(DFVLR-IB-22-85-A-29; ESA-CR(P)-2240; ETN-86-98118) Avail: NTIS HC A04/MF A01

An experimental study to test and verify an existing plume flow and plume impingement model was performod. Different test gases, stagnation conditions, and nozzles were used as parameters. Real hydrazine thruster plumes were treated. The interaction of two plumes and the impingement effects on a plate were investigated. ESA

N87-10962# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EVALUATION OF HEATER DESIGN CONCEPTS FOR HYDRAZINE DECOMPOSITION CHAMBERS Final Report
U. Renner, R. Tournier, H. D. Greif, and H. D. Schmitz Paris ESA 1986 143 p
(Contract ESTEC-3607/78-NL-AK)
(ESA-CR(P)-2239; ETN-86-98117) Avail: NTIS HC A07/MF A01

The requirements for heaters to be used for existing European hydrazine thrusters (catalytic) and on potential thrusters and gas generators (catalytic, electrothermal) were defined. Requirements of potential standardized heaters were derived as regards: electrical interfaces (power, voltage); heater life (total life of design or operating temperature, number of temperature cycles); and environmental conditions (vibration, shock, acceleration, ambient atmospheres, ambient temperature). The heater development was completed with hardware that was subjected to life testing with moderate success. Three of the six units tested survive the tests, but are degraded in element resistance more than is acceptable for flight hardware. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

N87-10963# Quality Assurance Directorate (Materials), London (England).
A SURVEY OF RECENT DEVELOPMENTS IN X-RAY DIFFRACTOMETRY
G. L. Marshall Dec. 1985 18 p
(MQAD-TR-910; BR98185; ETN-86-97982) Avail: NTIS HC A02/MF A01

The principles of powder X-ray diffractometry, including developments in computer control and peak identification routines are outlined. The use of specialist techniques, particularly the analysis of stress and texture is covered. Applications in metallurgy, polymer science, and ceramics are shown. ESA

N87-10964# California Univ., Berkeley. Lawrence Berkeley Lab.
CALCULATING AND PREDICTING THE PROPERTIES OF MATERIALS
S. G. Louie Apr. 1986 6 p Presented at the Workshop on Scientific Applications and Algorithm Design for High Speed Computing, Champaign, Ill., 7 Apr. 1986
(Contract DE-AC03-76SF-00098)
(DE86-011557; LBL-21470; CONF-8604176-2) Avail: NTIS HC A02/MF A01

Using microscopic theory, it is now possible to predict the structures and properties of real materials from first principles. This breakthrough was brought about by recent advances in the theory of the electronic structure of solids and by the availability of supercomputers. Many researchers in the field believe we are at the beginning of an era where we will be capable of designing materials with desirable properties using quantum theory and computers. DOE

N87-10934# Societe Nationale Industrielle Aerospatiale, Cannes (France).
SPACE TECHNOLOGIES AND MATERIALS: A LOOK BACK AND FUTURE PERSPECTIVES [TECHNOLOGIES ET MATERIAUX SPATIAUX: RETROSPECTIVE ET PERSPECTIVES D'AVENIR]

J. A. Massoni and J. L. Cecconi *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 347-351 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials*.

N87-10965# European Space Agency, Paris (France).
MATERIAL SELECTION FOR CARBON FIBER REINFORCED COMPOSITE STRUCTURES
Jan. 1986 174 p Transl. into ENGLISH of "Werkstoffauswahl fuer Verbundstrukturen aus CFK" Report DFVLR-Mitt-85-09, Jun. 1985 188 p Presented at Colloquium on Structural Mechanics, Brunswick, West Germany, 19 Jun. 1985 Original language document was announced as N86-14319
(ESA-TT-950; DFVLR-Mitt-85-09; ETN-86-98242) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

Composite structures for light constructions; influence of environmental conditions on carbon fiber reinforced plastics; carbon fiber reinforced plastic strength, and reaction to humidity and temperature; resin selection for application of specific carbon fiber types; fiber resin interface (chemical analysis); and the influence of various parameters on the microscopic fractograph of carbon fiber tensile test specimens were discussed. For individual titles, see N87-10966 through N87-10971.

N87-10966# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
ADVANCED COMPOSITES FOR LIGHTWEIGHT STRUCTURES
Guenther Niederstadt *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 7-20 Original language document was announced as N86-14320 (For primary document see N87-10965 02-24)
Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

The mechanical properties of composite structures were investigated regarding weight reduction for light construction, especially strength, stiffness and fracture strain behavior. Stress-strain diagrams for different composite structures are studied to obtain optimal fiber and resin matrix combinations with modified matrix ductility and data on the influence of environmental conditions on the composite structures. The time-dependent stress-strain behavior of conventional resin matrix composites can be described with isochronous stress-stress curves and depends on humidity, temperature and solar radiation. ESA

N87-10967# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
ENVIRONMENTAL INFLUENCES ON CFRP
Guenter Niederstadt *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 21-43 Original language document was announced as N86-14321 (For primary document see N87-10965 02-24)
Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

Responses of fiber and resin matrix in carbon fiber reinforced fibers to humidity, temperature, and solar radiation were studied. Responses to humidity include loss of mechanical properties (fracture strength and elasticity, deformability of the plastics) plus matrix swelling. Increased fracture strain leads to improved ductility of specific resin matrix systems. Responses to temperature rise include increased fracture strain, reduced strength and stiffness for plastics, and matrix thermal expansion. Responses to solar radiation include reduced molecular weight and mechanical strength, stress corrosion cracking for plastics, and matrix aging swelling. Coating of the carbon fiber structure surface with glass fibers or pure resin matrix systems is recommended to avoid strain corrosion due to the glass fiber laminate response to radiation. ESA

N87-10968# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
THE INFLUENCE OF MOISTURE AND TEMPERATURE ON THE STRENGTH BEHAVIOR OF CFRP
Michael Gaedke *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 44-90 Original language document was announced as N86-14322 (For primary document see N87-10965 02-24)
Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

The analytical prediction of material properties of multidirectional laminates at high or low temperatures in a matrix wet and dry state is discussed. The prediction is based on proven methods used for experimental determination of unidirectional ply properties. Prediction applicability is verified with results from tests on multidirectional laminates. The prediction and fiber composite material strength depend on the sorption and temperature-dependent internal stress. ESA

N87-10969# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
CHOICE OF RESIN WHEN USING DIFFERENT CARBON FIBER TYPES
Harald Twardy and Joachim Block *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 91-120 Original language document was announced as N86-14323 (For primary document see N87-10965 02-24)
Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

The effects of resin failure strain and of three different carbon fiber types on composite material behavior under tension load using rings were studied for crack-free laminate production. Measures using the acoustic energy method to detect fracture risk values confirm the influence of a flexible resin matrix on fracture occurrence. Yield limit points are determined for composite materials made of ST-3 and T-300 fibers. The effects of the matrix fracture propagation on the composite strength are studied. Further investigation of the applicability of high performance fibers with stretchable matrix resin is recommended. ESA

N87-10970# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
THE INTERFACE BETWEEN FIBER AND MATRIX RESIN FROM A CHEMICAL POINT OF VIEW
Helmut Greulich *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 121-145 Original language document was announced as N86-14324 (For primary document see N87-10965 02-24)
Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

The interface between fiber and resin was investigated for crack prevention along the fiber surface and composite early failure prevention due to a bad force transfer between fiber and resin consecutive to bad adhesion. Adhesion depends on the number of reactive carbonyl and carboxyl groups on the fiber surface and on the fiber preimpregnation with resin for reaction activation. A sizing material serves as an adhesion intermediate between fiber and resin. The structure of the sizing materials at the surface of commercial carbon fibers was examined using Auger electron spectroscopy and chromatographic methods. Electrochemical oxidation used to remove or modify the sizing material is recommended for an improved fiber integration to the resin matrix. The relationship between removed sizing degree and improved

fiber-resin adhesion was studied by measuring the interlaminar shear strength on unidirectional short bending test specimens and assessing the first ply failure point on tensile test specimens. A continued sizing removal applicance based on the results was developed. ESA

N87-10971# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.

INFLUENCE OF VARIOUS PARAMETERS ON THE MICROSCOPIC FRACTURE PATTERN OF TENSILE TEST SPECIMENS OF CFRP

Paul Nitsch *In* ESA Material Selection for Carbon Fiber Reinforced Composite Structures Jan. 1986 p 146-173 Original language document was announced as N86-14325 (For primary document see N87-10965 02-24)

Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50

The effects of water intake in the matrix, hardening and thermal cycling, temperature rise during loading, and increased resin ductility on the microscopic fractograph of carbon fiber reinforced plastics and pure epoxy resin under tension load were investigated regarding individual fiber fracture, adhesion failure, and microcrack formation in the matrix using a scanning electron microscope. Fiber/resin adhesion depends on the temperature and humidity content. Quantification of the fiber/resin adhesion with the mean fiber extension length shows a correlation with the residual tensile strength. ESA

N87-10972*# Christopher Newport Coll., Newport News, Va. Dept. of Physics.

DETERMINATION OF THE ULTRASONIC PROPERTIES OF COMPOSITES Annual Report, 5 Dec. 1983 - 5 Nov. 1984

B. T. Smith and A. M. Buoncristiani 1984 9 p

(Grant NAG1-431)

(NASA-CR-179799; NAS 1.26:179799) Avail: NTIS HC A02/MF A01 CSCL 11D

The research described encompasses two facets of the propagation of ultrasonic waves in composite structures: imaging of delaminations and the temperature dependence of the acoustical properties of composites. Progress in each area is summarized. B.G.

N87-10973*# Douglas Aircraft Co., Inc., Long Beach, Calif.

CRITICAL JOINTS IN LARGE COMPOSITE AIRCRAFT STRUCTURE Contractor Report, Nov. 1981 - Jan. 1983

Willard D. Nelson, Bruce L. Bunin, and Leonard John Hart-Smith Washington NASA Aug. 1983 41 p Presented at the 6th Conference on Fiberous Composites in Structural Design, New Orleans, La., 24-27 Jan. 1983

(Contract NAS1-16857)

(NASA-CR-3710; NAS 1.26:3710; DP-7266) Avail: NTIS HC A03/MF A01 CSCL 11D

A program was conducted at Douglas Aircraft Company to develop the technology for critical structural joints of composite wing structure that meets design requirements for a 1990 commercial transport aircraft. The prime objective of the program was to demonstrate the ability to reliably predict the strength of large bolted composite joints. Ancillary testing of 180 specimens generated data on strength and load-deflection characteristics which provided input to the joint analysis. Load-sharing between fasteners in multirow bolted joints was computed by the nonlinear analysis program A4EJ. This program was used to predict strengths of 20 additional large subcomponents representing strips from a wing root chordwise splice. In most cases, the predictions were accurate to within a few percent of the test results. In some cases, the observed mode of failure was different than anticipated. The highlight of the subcomponent testing was the consistent ability to achieve gross-section failure strains close to 0.005. That represents a considerable improvement over the state of the art. Author

N87-10974*# Douglas Aircraft Co., Inc., Long Beach, Calif.

DC-10 COMPOSITE VERTICAL STABILIZER GROUND TEST PROGRAM Contractor Report, Dec. 1980 - May 1982

J. M. Palmer, Jr., C. O. Stephens, and J. O. Sutton Washington NASA Aug. 1983 38 p Presented at the 6th Conference on Fiberous Composites in Structural Design, New Orleans, La., 24-27 Jan. 1983

(Contract NAS1-14869)

(NASA-CR-3715; NAS 1.26:3715; DP-7269) Avail: NTIS HC A03/MF A01 CSCL 11D

A review of the structural configuration and ground test program is presented. Particular emphasis is placed on the testing of a full-scale stub box test subcomponent and full span ground test unit. The stub box subcomponent was tested in an environmental chamber under ambient, cold/wet, and hot/wet conditions. The test program included design limit static loads, fatigue spectrum loading to approximately two service lifetimes (with and without damage), design limit damage tolerance tests, and a final residual strength test to a structural failure. The first full-scale ground test unit was tested under ambient conditions. The test unit was to have undergone static, fatigue, and damage tolerance tests but a premature structural failure occurred at design limit load during the third limit load test. A failure theory was developed which explains the similarity in types of failure and the large load discrepancy at failure between the two test articles. The theory attributes both failures to high stress concentrations at the edge of the lower rear spar access opening. A second full-scale ground test unit has been modified to incorporate the various changes resulting from the premature failure. The article has been assembled and is active in the test program. Author

N87-10975*# Douglas Aircraft Co., Inc., Long Beach, Calif.

CRITICAL COMPOSITE JOINT SUBCOMPONENTS: ANALYSIS AND TEST RESULTS

B. L. Bunin Washington NASA Sep. 1983 155 p

(Contract NAS1-16857)

(NASA-CR-3711; NAS 1.26:3711; ACEE-26-TR-3074) Avail: NTIS HC A08/MF A01 CSCL 11D

This program has been conducted to develop the technology for critical structural joints of a composite wing structure meeting design requirements for a 1990 commercial transport aircraft. A prime objective of the program was to demonstrate the ability to reliably predict the strength of large bolted composite joints. Load sharing between bolts in multirow joints was computed by a nonlinear analysis program (A4FJ) which was used both to assess the efficiency of different joint design concepts and to predict the strengths of large test articles representing a section from a wing root chord-wise splice. In most cases, the predictions were accurate to within a few percent of the test results. A highlight of these tests was the consistent ability to achieve gross-section failure strains on the order of 0.005 which represents a considerable improvement over the state of the art. The improvement was attained largely as the result of the better understanding of the load sharing in multirow joints provided by the analysis. The typical load intensity on the structural joints was about 40 to 45 thousand pound per inch in laminates having interspersed 37 1/2-percent 0-degree plies, 50-percent + or - 45-degrees plies and 12 1/2-percent 90-degrees plies. The composite material was Toray 300 fiber and Ciba-Geigy 914 resin, in the form of 0.010-inch thick unidirectional tape. Author

N87-10976*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

ANISAP: A THREE-DIMENSIONAL FINITE ELEMENT PROGRAM FOR LAMINATED COMPOSITES SUBJECTED TO MECHANICAL LOADING

Stephen W. Burns, Steven Mathison, and Carl T. Herakovich Jul. 1986 70 p

(Grant NAG1-343)

(NASA-CR-179867; NAS 1.26:179867; VPI-E-86-12; CCMS-86-03; IR-59) Avail: NTIS HC A04/MF A01 CSCL 11D

ANISAP is a 3-D finite element FORTRAN 77 computer code for linear elastic, small strain, analysis of laminated composites

with arbitrary geometry including free edges and holes. Individual layers may be isotropic or transversely isotropic in material principal coordinates; individual layers may be rotated off-axis about a global z-axis. The laminate may be a hybrid. Three different isoparametric elements, variable order of gaussian integration, calculation of stresses at element boundaries, and loading by either nodal displacement of forces are included in the program capability. Post processing capability includes failure analysis using the tensor polynominal failure criterion. Author

N87-10977*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EFFECTS OF SPACE RADIATION ON A CHEMICALLY MODIFIED GRAPHITE-EPOXY COMPOSITE MATERIAL Interim Report
Susan M. Reed (Virginia Polytechnic Inst. and State Univ., Blacksburg), Carl T. Herakovich, and George F. Sykes Oct. 1986 97 p
(Grant NAG1-343)
(NASA-TM-89232; NAS 1.15:89232; CCMS-86-06; VPI-E-86-19; IR-60) Avail: NTIS HC A05/MF A01 CSCL 11D

The effects of the space environment on the engineering properties and chemistry of a chemically modified T300/934 graphite-epoxy composite system are characterized. The material was subjected to 1.0 x 10 to the 10th power rads of 1.0 MeV electron irradiation under vacuum to simulate 30 years in geosynchronous earth orbit. Monotonic tension tests were performed at room temperature (75 F/24 C) and elevated temperature (250 F/121 C) on 4-ply unidirectional laminates. From these tests, inplane engineering and strength properties (E sub 1, E sub 2, Nu sub 12, G sub 12, X sub T, Y sub T) were determined. Cyclic tests were also performed to characterize energy dissipation changes due to irradiation and elevated temperature. Large diameter graphite fibers were tested to determine the effects of radiation on their stiffness and strength. No significant changes were observed. Dynamic-mechanical analysis demonstrated that the glass transition temperature was reduced by 50 F(28 C) after irradiation. Thermomechanical analysis showed the occurrence of volatile products generated upon heating of the irradiated material. The chemical modification of the epoxy did not aid in producing a material which was more radiation resistant than the standard T300/934 graphite-epoxy system. Irradiation was found to cause crosslinking and chain scission in the polymer. The latter produced low molecular weight products which plasticize the material at elevated temperatures and cause apparent material stiffening at low stresses at room temperature. Author

N87-10978# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
RELAXATION PROPERTIES OF SOME SEGMENTED POLYURETHANE-CaCO3 COMPOSITES. A DIELECTRIC STUDY
James C. Chien, Gyorgy Banhegyi, Man-Khyun Rho, and Frank E. Karasz 8 May 1986 38 p
(Contract N00014-85-K-0880)
(AD-A169398; TR-14) Avail: NTIS HC A03/MF A01 CSCL 11/4

Dielectric relaxation in three segmented polyurethane CaCO3 composites was investigated between -70 C and +150 C in the 300 Hz to 100 kHz frequency range. Two of the polymers contained a polyacetal-polyester soft segment, while the soft component of the third polymer was polypropylene oxide. The hard segments consisted of 4,4' -diphenyl methane diisocyanate in two cases and toluene-2,4-diisocyanate in the third case. In parallel studies two calorimetric relaxations, designated alpha and alpha prime, were observed for each sample and were determined to be glass transitions of the soft and hard segments, respectively. In general, the transitions temperatures decrease with increasing filler content. High frequency, low temperature permittivities increase while low frequency, high temperature AC conductivities generally decrease with increasing filler content. The shift in the transition temperatures can be explained using the adsorption theory of filler-polymer interactions and the densities of the samples. The interfacial polarization mechanism becomes important only above the alpha and alpha prime transition temperature and below 1 kHz. GRA

N87-10979# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
MODEL FOR PREDICTION OF THE ELASTIC RESPONSE OF COMPOSITE MATERIALS OVER WIDE RANGES OF CONCENTRATION
James C. Chien, Jorge N. Farber, and Richard J. Farris 8 May 1986 25 p
(Contract N00014-86-K-0880)
(AD-A169399; TR-15) Avail: NTIS HC A02/MF A01 CSCL 11/4

A model for the prediction of the elastic response of composite material over wide ranges of concentration is presented. The method is based on the mathematical analogy between the motion of particles suspended in viscous media and the elastic deformation of solids. The system is locally described by linearized forms of the elastic moduli. The validity of these relations is then extended to all concentrations under the assumption that any new portion of filler sees the existing composite as a non-interacting homogeneous matrix. The method predicts the behavior of composites with solid spherical inclusions and foams over wide ranges of concentration. The model, free from adjustable parameters, shows excellent agreement with existing experimental data. The extension of the method to other inclusion geometries is straightforward. GRA

N87-10980# Oak Ridge National Lab., Tenn.
WHISKER-REINFORCED CERAMIC COMPOSITES
T. N. Tiegs and P. F. Becher 1986 9 p Presented at the 2nd International Symposium on Ceramic Materials and Components for Engines, Luebeck-Travemuende, West Germany, 14 Apr. 1986
(Contract DE-AC05-84OR-21400)
(DE86-011058; CONF-860413-3) Avail: NTIS HC A02/MF A01

Substantial fracture toughness and strength improvements for alumina and mullite matrix composites have been demonstrated. Oxidation of the SiC whiskers in the alumina based composite is apparently by oxygen transport through the matrix and along grain boundaries. Densities of alumina-SiC whisker composites fabricated by pressureless sintering were a function of the whisker content. Densities greater than 95% of theoretical can be achieved with whisker contents of 10 vol %. The mechanical property gains of the whisker reinforced composites compared to monolithic ceramics are impressive. Even further improvements in mechanical properties can be attained by combining whisker reinforcement with addition of zirconia particles. DOE

N87-10981# Oak Ridge National Lab., Tenn.
STRAIN CONTRAST IN SiC WHISKER REINFORCED Al SUB 2 O SUB 3
P. Angelini and W. Mader (Max-Planck-Inst. fuer Metallforschung, Stuttgart, West Germany) 1986 3 p Presented at the Annual Joint Meeting of the Electron Microscopy of America and the Microbeam Analysis Society, Albuquerque, N. Mex., 10 Aug. 1986 Prepared in cooperation with Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.); Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.); Inst. fuer Werkstoffwissenschaften
(Contract DE-AC05-84OR-21400)
(DE86-009537; CONF-860829-19) Avail: NTIS HC A02/MF A01

Whisker reinforced ceramic materials offer the potential for increased fracture toughness and fracture strength. Residual stresses resulting from differences in thermal expansion properties of the matrix and the whisker can develop during cooling and affect mechanical properties. TEM strain contrast of large inclusions has previously been observed for nearly spherical particles of ZrO2 in Al2O3 matrix grains. The formation of strain contrast oscillations was explained and a quantitative analysis of strains around ZrO2 inclusions in Al2O3 was performed. The present research is concerned with characterizing by TEM the strain field present in Al2O3 reinforced with SiC whiskers. DOE

N87-10982# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
COMPOSITES DESIGN HANDBOOK FOR SPACE STRUCTURE APPLICATIONS. EXECUTIVE SUMMARY Final Report
Paris ESA Sep. 1985 6 p
(Contract ESTEC-5816/84-NL-PB(SC))
(ESA-CR(P)-2196; ETN-86-98082) Avail: NTIS HC A02/MF A01

The ESA composites design handbook is divided into eight main chapters. These chapters are entitled: Handbook organization and user instructions; Material properties and applications; Calculation methods of laminates; General design aspects; Load transfer and design of joints; Structural design; Integrity control; and Verification guidelines. ESA

N87-10929# MATRA Service Aerodynamique, Le Chesnay (France). Mechanical Engineering Dept.
STRUCTURAL DEVELOPMENT OF THE TELESCOPE STRUCTURE OF THE HIPPARCOS SATELLITE PAYLOAD
J. P. Allard *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 315-319 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10931# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
GRAZING-INCIDENCE MIRROR CARRIERS MADE OF CARBON FIBER REINFORCED EPOXY MATRIX SYSTEM
J. Klug *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 329-334 Sponsored by ESA (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10932# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
THE K1-K2 INTERACTION FOR MATRIX SPLITTING IN UNIDIRECTIONAL LAMINATES OF CARBON FIBER REINFORCED EPOXY
H. Eggers and L. Kirschke *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 335-340 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10933# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Fachbereich Technische Mechanik.
DEBONDING ANALYSIS OF THERMALLY STRESSED FIBER-REINFORCED COMPOSITE MATERIALS
F.-G. Buchholz and K.-H. Senger *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 341-346 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
PERFORMANCE CHARACTERISTICS OF COMPOSITE MATERIALS
H. W. Bergmann, M. Gaedke, and H. C. Goetting *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 353-359 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10936# Engineering System International, Rungis (France).
NUMERICAL CALCULATION OF DAMAGE TOLERANCE AND ADMISSABLE STRESS IN COMPONENTS MADE OF COMPOSITE MATERIALS USING THE PAM-FISS/BI-PHASE MATERIAL MODEL
E. Haug, P. Dowlatyari, and A. deRouvray *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 361-371 Sponsored by ESA (For primary document see N87-10886 02-18)
(Contract DRET-SDR-G8)
Avail: NTIS HC A19/MF A01

N87-10940# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
A METHOD OF STUDYING THE BEHAVIOR OF COMPOSITE MATERIALS IN SIMULATED SPACE ENVIRONMENTS [MOYEN D'ETUDE DU COMPORTEMENT EN AMBIANCE SPATIALE SIMULEE DE MATERIAUX COMPOSITES]
F. Albugues, P. Plotard, M. F. Gomez (Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France), A. Paillous, and M. D. Judd (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 393-397 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N87-10983 British Petroleum Co. Ltd., London (England).
CATALYTIC PRODUCTION OF CARBOXYLIC ACIDS OR ANHYDRIDES FROM OLEFINS Patent Application
John Cook Filed 21 Nov. 1984 3 p Filed 21 May 1983
(GB-PATENT-2-140-004-A; PATENT-APPL-8314139;
INT.CLASSC07C27/2253/1253/12;
DOMESTIC-CLASS-C2C20Y304-30Y;
DOMESTIC-CLASS-B1E-1143-1180;
DOMESTIC-CLASS-U1S-2420-B1E-; ETN-86-98024) Avail: UK Patent Office

A carboxylic acid or an anhydride is prepared by reacting, at elevated temperature and superatmospheric pressure, an olefin with carbon monoxide and a carboxylic acid in the liquid phase and in the presence of a supported Group 8 metal catalyst, preferably rhodium. The reaction using the heterogeneous catalyst can be performed in the liquid phase. It is relatively easy to recover and recycle the catalyst. ESA

N87-10984# Quality Assurance Directorate (Materials), London (England).
CORROSION BY POLYURETHANE ANTISTATIC FOAMS
V. M. Evans, A. J. Pidduck, and K. S. Smith Aug. 1984 22 p
(MQAD-R-343; BR95123; ETN-86-97981) Avail: NTIS HC A02/MF A01

Following a defect involving severe corrosion of foam-packaged microelectronic devices, commercially available conductive polyurethane foams were characterized using chemical tests. The results were used to devise a specification to prevent recurrence of such failures. Two of the foam types cause unacceptable corrosion of zinc test specimens. Mass spectrometry and other micro-analytical techniques were applied to investigate the origin of this. Corrosion was traced to poly (vinyl acetate) and polychloroprene, present as binders for the carbon black antistatic agent. There is little evidence for corrosion by the polyurethane itself, or by the acrylic-based binders used in most other foams. ESA

N87-10985# Federal Aviation Administration, Atlantic City, N.J.
AN INVESTIGATION OF THE FAA VERTICAL BUNSEN BURNER FLAMMABILITY TEST METHOD Final Report
Patricia Cahill Aug. 1986 15 p
(DOT/FAA/CT-86/22) Avail: NTIS HC A02/MF A01

The vertical Bunsen burner test method, as specified in appendix F of the Federal Aviation Regulations - Part 25, was evaluated in order to update and clarify certain problem areas. Burner fuel, flame temperature and flame placement were investi-

gated. It was determined that: (1) methane gas can be used as a replacement of alternative to B-gas, (2) a minimum flame temperature specification is meaningless without specifying thermocouple wire thickness, and (3) placing the flame at the midpoint of the lower edge of the front face results in a more realistic and severe evaluation of the specimen's flammability properties. Author

N87-10986# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELECTRICAL CONDUCTIVITY MEASUREMENTS OF HYDROXYLAMMONIUM NITRATE: DESIGN CONSIDERATIONS Final Report
John A. Vanderhoff and Steven W. Bunte Apr. 1986 26 p
(AD-A168138; BRL-MR-3511) Avail: NTIS HC A03/MF A01 CSCL 07/4

The phenomenon of electrical conductance in aqueous salt solutions is of great interest to both experimental and theoretical scientists alike. Electrical conductivity can be used as a tool for elucidating the dynamics of ions in solutions. Our interest lies in the liquid structure and transport properties in aqueous solutions of hydroxylammonium nitrate (HAN), a major component in candidate liquid gun propellants. This report reviews the experimental considerations in making electrical conductivity measurements on aqueous salt solutions, such as HAN. Conductance measurements as a function of HAN concentration are also reported; discussions as to the meaning of these curves and possible similarities with Raman spectra will be the subject of a future report. GRA

N87-10987# Virginia Univ., Charlottesville.
METAL ION-PROMOTED SYNTHESES OF BORANES AND CARBORANES Final Report, 1 Jan. 1983 - 14 Mar. 1986
Russell N. Grimes 2 Jun. 1986 10 p
(Contract DAAG29-83-K-0030)
(AD-A169189; ARO-19953.9-CH) Avail: NTIS HC A02/MF A01 CSCL 07/3

Controlled synthetic routes to new boron hydrides, carboranes, and metal-carborane complexes have been developed and a number of structurally novel species have been prepared and characterized. The oxidative fusion method for synthesis of boranes and carboranes has been further extended and its mechanism explored. The chemistry of small (7-vertex) metallacarboranes having reactive metal centers has been examined. Practical routes to metalarene-carborane sandwich complexes have been developed. GRA

N87-10988# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAT TRANSFER DURING LAMINAR FLOW FLAME QUENCHING: EFFECT OF FUELS
W. M. Huang, S. R. Vosen, and R. Greif Dec. 1985 24 p Presented at the 21st International Symposium on Combustion, Munich, West Germany, 3 Aug. 1986
(Contract DE-AC03-76SF-00098)
(DE86-007490; LBL-20863; CONF-860804-9) Avail: NTIS HC A02/MF A01

Wall heat fluxes were obtained in a constant volume combustion chamber for methane-air, ethylene-air and propane-air mixtures. The experiments were performed at pressure near atmospheric over a range of equivalence ratios from 0.8 to 1.2. The unsteady heat fluxes for the three fuels were all correlated by using the heat release rates of the flames prior to quenching and the thermal diffusivity and the flame speed. The calculations were made using a finite difference method and an integral method. Two step chemical kinetics was used in the finite difference calculations and a simplified ignition temperature approach was employed in the integral method. The results from the finite difference calculation were in good agreement with the experimental data. In the integral method, choosing a single value for the dimensionless ignition temperature for all three fuels also yielded good agreement with the experimental data. The maximum wall heat flux accounts for one third of the steady laminar flame heat release rate for three fuels. DOE

N87-10989# Kiruna Geophysical Inst. (Sweden).
A NEW WAY OF ORGANIZING SPECTRAL LINE INTENSITY RATIO FLUCTUATIONS OF DIFFERENT ELEMENTS
B. Thelin Feb. 1986 23 p
(KGI-Preprint-088; ISSN-0349-2656; ETN-86-97850) Avail: NTIS HC A02/MF A01

An analysis method of organizing spectral line intensity ratio fluctuations for different elements was developed to see which line pair of analysis is more or less stable at repeated measurements. A linear graph was obtained for spectral lines from different elements when the spectral line ratio fluctuations were plotted versus the photon energies and the ionization energies of these lines. When these fluctuations were plotted versus the upper energies instead, no linear structure is obtained. This means that there is no linearity with the conventional intensity formula with the Boltzmann exponent, but there is if exp[(hnu [sub mn + J)kt] is used. ESA

N87-10990# European Space Agency, Paris (France).
RESULTS OF WIND TUNNEL TESTS ON EXTERNAL COMBUSTION
Berthold Schaefer Dec. 1985 52 p Transl. into ENGLISH from "Ergebnisse von Windkanalversuchen zur Aussenverbrennung" (Cologne, West Germany) Original language document was announced as N86-15643
(ESA-TT-959; DFVLR-FB-85-35; ETN-86-98245) Avail: NTIS HC A04/MF A01; original German version available at DFVLR, Cologne, West Germany DM 56

Wind tunnel tests on external combustion were carried out to study the flow distribution on a flat plate in a supersonic flow for spoiler optimization and combustion efficiency. The influence of spoiler geometry, mass flow rate and injection angle on flow distribution was studied. The separation area can be enlarged with the spoiler inclination against the flow. Resistance problems and mass flow rate against a split overture are reduced with a hole-line flow nozzle. The area of increased pressure is enlarged by injecting hydrogen in the recirculation area before the spoiler and by igniting the mixture. The cross force after ignition is five times as strong as the spoiler action. ESA

N87-10991# Renault Vehicles Industriels (France).
APPLICATIONS OF BASIC RESEARCH TO DIESEL COMBUSTION OPTIMIZATION
X. Lys, M. Bidault, and C. Henault 1986 10 p In FRENCH; ENGLISH summary Sponsored by French Ministere de la Recherche et de la Technologie, and Groupement Scientifique Moteurs
(ETN-86-98411) Avail: NTIS HC A02/MF A01

The rules and the process to set up diagnostics and laws of diesel combustion optimization are described. They are based on research conducted outside and inside the engine on aerodynamic field characterization and jet behavior. Models are compared with flow visualization and measurements, for the optimization of the combustion chamber of a single cylinder industrial vehicle engine. The results are extended to automotive diesel engines. ESA

N87-10992# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
COMBUSTION IN TURBULENT JETS AND BUOYANT FLAMES Annual Report, 1 Dec. 1984 - 30 Nov. 1985
P. E. Dimotakis, J. E. Broadwell, and E. E. Zukoski 26 Dec. 1985 54 p
(Contract GRI-5083-260-0878)
(PB86-203205; GRI-86/0034) Avail: NTIS HC A04/MF A01 CSCL 21B

Results are reported from an ongoing investigation of the entrainment and mixing mechanisms in momentum-dominated turbulent jets, buoyancy-dominated turbulent plumes, and flows which undergo a transition between these two regimes. The investigation also addresses the effects of molecular diffusion rates (Schmidt number) and combustion heat release on these mechanisms and incorporates them into practical modeling and predic-

tive techniques for combustion in these flows. Laser soot-scattering measurements in a large buoyant diffusion flame have provided a detailed picture of the wrinkled, convoluted flamelet structure of the soot distribution. The full scale momentum-driven/transitional jet experimental facility has been completed and preliminary data have been collected. Fabrication of the high pressure reactant tank for turbulent reacting jet experiments has been completed and installation is underway. This study of the transition between momentum- and buoyancy-controlled jets allows one to make estimates in flows without combustion and this study has characterized several flow regimes in combusting flows and identified the important parameters relevant to the transition in combusting flows. The authors have developed a quantitative model for the effects of stoichiometric ratio, Reynolds number, Schmidt number, and Damkohler number in the turbulent shear layer and have compared this model with experiments. GRA

N87-11181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION OVERVIEW
Donald F. Schultz *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21B

N87-11204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLAME RADIATION
J. D. Wear *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21B

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N87-10993 Central Electricity Generating Board, London (England). Translaton Section.
EFFECT OF CREEP DAMAGE ON FATIGUE LIFE OF Cr-Mo-V STEEL
Norio Shinya, Junro Kyono, Hideaki Kushima, and Shin Yokoi 1986 15 p Transl. into ENGLISH from Zairyo (Japan), v. 34, no. 379, 1985 p 436-441
(BLL-CE-Trans-8212-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of creep damage on high temperature low cycle fatigue endurance was investigated for the Cr-Mo-V steel used in steam turbine rotors. Creep damage was monitored by scanning electron microscopy and density change measurements for creep specimens withdrawn from testing at different stages of creep. Specimens with a predetermined amount of creep damage so estimated were then subjected to high temperature low cycle fatigue testing together with aged specimens and their fatigue fracture characteristics were identified. B.G.

N87-10994 British Aerospace Aircraft Group, Bristol (England). Advanced Manufacturing Research Dept.
INTERNATIONAL CONFERENCE - SUPERPLASTICITY IN AEROSPACE ALUMINIUM
K. S. Broad, comp. 23 Jul. 1985 12 p Conference held in Bedford, England, 12-15 Jul. 1985
(BAe-S85/AMR/0066; ETN-86-97945) Avail: Issuing Activity

The use of superplastic aluminum in aerospace was discussed. Superplastic forming to produce cost effective lightweight parts was considered. Limitations from microstructural fractures and resultant properties were covered, particularly the problem of cavitation. Special processing techniques and the evolution of alloys to overcome limitations were treated. ESA

N87-10995# Battelle Columbus Labs., Ohio.
CURRENT AWARENESS BULLETIN: METALS AND CERAMICS
Jun. 1986 8 p
(CAB-160) Avail: NTIS HC A02/MF A01

Topics addressed include: light metals, surface finishing, and ceramics. Upcoming meetings/symposia are listed. B.G.

N87-10996# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
DESIGN OF LOW ALLOY STEELS FOR THICK WALLED PRESSURE VESSELS Final Technical Report, 1 Feb. 1980 - 30 May 1985
R. O. Ritchie, J. A. Todd, P. N. Spencer, and E. R. Parker Jun. 1985 165 p
(Contract DE-AC05-84OR-21400)
(DE86-011748; ORNL/Sub-80-7843/01; UCB/RP-85/D1034) Avail: NTIS HC A08/MF A01

This report presents results of the five year research program, Design of Low Alloy Steels for Thick Walled Pressure Vessels. The objective of the program was to modify existing commercial low alloy steels and to develop new alloys to satisfy the material requirements for thick section plate up to 400 mm (16 in.) to be used for construction of the large pressure vessels envisioned for second and third generation coal conversion systems. A new series of experimental 3Cr-Mo-Ni steels were produced and investigated for suitability as improved materials for large thick section coal conversion pressure vessels. These new steels rely on minor alloy modifications to commercial 2-1/4Cr-1Mo (ASTM A387 Grade 22 Class 2) steel. Hardenability, yield strength, tensile ductility, Charpy V-notch impact toughness, hydrogen attack resistance, and creep rupture and temper embrittlement resistance were investigated. Initial studies on fatigue crack propagation in hydrogen attacked steel, and fracture toughness (K/sub Ic/) studies were carried out. It was found that the new steels are superior to 2-1 /4Cr-1Mo steel with respect to hardenability, room temperature strength, impact toughness and resistance to hydrogen attack. Moreover, their mechanical properties compare very favorably with other 3Cr-Mo steels recently developed by Climax Molybdenum Company and the Japan Steel Works. DOE

N87-10997# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
COMPARISON OF THE EFFECTS OF ALLOYED MOLYBDENUM AND AQUEOUS MOLYBDATE ON THE PITTING RESISTANCE OF IRON-CHROMIUM ALLOYS Final Technical Report
R. E. Wistrom and D. J. Duquette 1985 21 p
(Contract DE-FG02-84ER-45101)
(DE86-011918; DOE/ER-45101/1) Avail: NTIS HC A02/MF A01

Electrochemical techniques were employed to compare and contrast the roles of alloyed Mo and aqueous MoO4(2-) in enhancing pitting resistance of ferritic stainless steels in neutral chloride solutions at 80 C. Results indicate that alloyed Mo inhibits pitting in 0.14N and 1N chloride solutions while aqueous moO4(2-) inhibits in the dilute Cl- solution only. Prepassivation experiments show that the major role of high Clconcentrations is to prevent MoO4(2-) from forming a passive film rather than in attacking the film after it has formed. Alloyed Mo and aqueous MoO4(2-) both inhibit pitting through incorporation into the passive film but incorporation from the solution is easily influenced by solution variables such as chloride concentration. DOE

N87-10998# Auburn Univ., Ala. Dept. of Mechanical Engineering.
EFFECT OF STRAIN RATE AND TEMPERATURE ON THE PROPERTIES OF (Fe,Ni) V LONG RANGE ORDERED ALLOYS Final Report
B. A. Chin, R. C. Wilcox, and H. T. Lin Dec. 1985 53 p
(Contract DE-AS05-82ER-52089)
(DE86-011967; DOE/ER-52089/T1) Avail: NTIS HC A04/MF A01

This final report describes the effects of strain rate, temperature and long-term thermal aging on the properties of the (Fe,Ni)V long range ordered (LRO) alloys. Tensile tests were performed at room and elevated temperature, and at different strain rates. The macroscopic and microscopic deformation and fracture characteris-

tics, along with controlling mechanisms, were examined using scanning electron microscopy techniques. The ordered alloys were found to have good high-temperature strength compared to conventional fusion alloys such as 316SS. Additionally, the mechanical properties were shown to be insensitive to strain rate and long-term thermal aging. Scanning electron microscopy analyses showed that the deformation and fracture mechanisms change as a function of strain rate, temperature and aging time.
DOE

N87-10999# Sandia National Labs., Albuquerque, N. Mex.
PHYSICAL METALLURGY ISSUES IN SOLDER JOINT PERFORMANCE
J. J. Stephens, Jr. and R. J. Bourcier 1986 18 p Presented at the 14th Concentrator Photovoltaic Integration, Albuquerque, N. Mex., 10 Jun. 1986
(Contract DE-AC04-76DP-00789)
(DE86-010961; SAND-86-2080C; CONF-8606123-1) Avail: NTIS HC A02/MF A01

In order to simulate solder fabrication, a simplified axisymmetric microcell model of the assembly was used. Results of constant temperature compressive creep experiments were fitted to the Sherby-Dorn steady state creep equation for use in the analyses. Experimental studies have been performed to evaluate the effect of material layup, solder joint thickness, and number of thermal cycles on the tensile strength of solder bonds. DOE

N87-11000# Oak Ridge National Lab., Tenn.
RELATIONSHIP OF AN ALLOY'S MECHANICAL PROPERTIES TO ITS RESPONSE TO INDIVIDUAL EROSIVE PARTICLE IMPACTS
J. R. Keiser 1986 16 p Presented at the 3rd Berkeley Conference on Elevated Temperature Corrosion-Erosion-Wear of Materials, Berkeley, Calif., 29 Jan. 1986
(Contract DE-AC05-84OR-21400)
(DE86-011778; CONF-860104-1) Avail: NTIS HC A02/MF A01

Deformation accompanying single-particle impacts was studied on selected ductile metals to gain insight into the mechanisms of erosion and erosion-corrosion damage. We examined the effects of heat treatment and prior cold work on crater volumes and geometries left by the impact of hard spherical particles traveling at known velocities. One material was further characterized by hardness measurements in and near impact craters. Individual impact tests were run on a material that had been exposed to multiple-particle impacts in a conventional erosion test apparatus. These test results were used to evaluate current theories on the effects of the properties of target materials on erosion behavior.
DOE

N87-11001# Rolls-Royce Ltd., Derby (England).
THE GROWTH OF FATIGUE CRACKS IN A NICKEL BASE SINGLE CRYSTAL
C. Howland 5 Mar. 1986 24 p Presented at 2nd Symposium on Short Cracks, Sheffield, England, 25-28 Sep. 1985
(PNR-90310; ETN-86-98019) Avail: NTIS HC A02/MF A01

The growth of fatigue cracks in a precipitation strengthened single crystal superalloy was investigated using a specimen design with a unique crystallographic orientation. Testing was limited to room temperature, with peak and mean stress being the primary variables. The work provided data for component lifing purposes and information which can be used in modeling short fatigue crack growth in fcc materials which also occurs on specific slip planes. Fatigue crack growth at room temperature is observed to be exclusively crystallographic, occurring on 111 planes. Presentation of the data in terms of the alternating stress intensity, reveals a simple progression with data at R = 0.8 being fastest, and R = 0.1 being slowest. The observed trends in the data suggest the operation of a simple closure mechanism, although the inherent smoothness of the fracture surfaces tends not to support this.
ESA

N87-11002# Utrecht State Univ. (Netherlands). Vakgroep Anorganische Chemie.
HIGH TEMPERATURE OXIDATION OF ALLOYS. OXIDATION MECHANISMS AND EXPERIMENTAL METHODS Ph.D. Thesis
Edward Willem Albert Young 1986 91 p Partly in ENGLISH and DUTCH
(ETN-86-98071) Avail: NTIS HC A05/MF A01

Investigation by X-ray photoelectron spectroscopy of the transient oxidation of NiAl; the application of Rutherford backscattering spectrometry on the study of high temperature corrosion processes emphasizing the oxidation of NiAl; Rutherford backscattering spectrometry as an experimental method to study the oxidation mechanism of NiAl3 alloy; the use of O18 tracer and Rutherford backscattering spectrometry to study the oxidation of NiAl; the use of markers and tracers to establish the growth mechanism of alumina scales during high temperature oxidation; an O18 tracer study on the growth mechanism of alumina scales on NiAl and NiAlY alloys; the relation between oxide structure and oxidation mchanism of alumina scales on NiAl; high temperature oxidation of IN617; n-type behavior of chromium (III) oxide; and the defect structure of chromium (III) oxide as a function of the oxygen partial pressure are discussed. The present work was undertaken to contribute to a better understanding of high temperature oxidation processes. Attention was focused on the transport properties of the oxides, since these have a major influence on the oxidation mechanisms of alloys. ESA

N87-11003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Korrosion.
GALVANIC CORROSION BETWEEN CARBON FIBER REINFORCED PLASTICS AND METALLIC AERONAUTICAL MATERIALS
Thierry Fourrier and Horst Buhl Apr. 1986 86 p
(DFVLR-FB-86-16; ISSN-0171-1342; ETN-86-98184) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 27

The electrochemical behavior of carbon fiber reinforced plastics (CFRP) and the galvanic corrosion between CFRP and metallic aeronautical alloys were investigated. Rest potentials, mixed potentials, galvanic current densities, and polarization curves were measured. Influence of parameters such a pH-value, electrolyte agitation, distance between the samples, and area ratio was studied. Aluminium alloys (2024, 7010, 7050, 7075, 8090) show a high sensitivity to galvanic corrosion with CFRP; Ti-6A1-4V is the only alloy with uncritical galvanic corrosion behavior with CFRP.
ESA

N87-11004# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
CORROSION AND CORROSION PREVENTION IN AIRCRAFT STRUCTURES
W. G. J. tHart Mar. 1985 25 p In DUTCH; ENGLISH summary Presented at PBNA Course on Corrosion Prevention, Utrecht, Netherlands, 16-23 Apr. and 7-14 May 1985
(NLR-MP-85029-U; B8667275; ETN-86-98490) Avail: NTIS HC A02/MF A01

Materials used in aircraft and the operational environments which cause the different kinds of corrosion are presented. The corrosion-sensitive parts of aircraft structures are discussed. Measures to provide optimal corrosion prevention (choice of materials, metallic coatings, surface treatment, painting) are reviewed. Measures to be taken during the design phase and during maintenance are outlined. ESA

N87-11005# Osaka Gas Co. Ltd. (Japan).
CRACK ARREST PROPERTIES OF 9 PERCENT NICKEL STEEL AND RELATION BETWEEN CRACK-INITIATION AND CRACK-ARREST TESTS Final Report, Nov. 1982 - Dec. 1985
28 Feb. 1986 142 p Sponsored by Gas Research Inst. Prepared in cooperation with Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan, Nippon Steel Corp, Tokyo, Japan and Sumitomo Metal Industries Ltd., Osaka, Japan
(PB86-213964; GRI-86/0007) Avail: NTIS HC A07/MF A01 CSCL 11F

Brittle fracture initiation and arrest properties of various 9% nickel steel plates and their weld joints were studied by means of

various fracture toughness test methods as the crack tip opening displacement, compact crack arrest, ESSO, short crack arrest and Wells wide plate tests. The results were analized by static and dynamic fracture mechanics and correlations between tests were established. GRA

N87-11182*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE PROTECTION
Stanley R. Levine *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11F

N87-11192*# Analex Corp., Dayton, Ohio.
EXPERIMENTAL VERIFICATION OF VAPOR DEPOSITION MODEL IN MACH 0.3 BURNER RIGS
Sueleyman A. Goekoglu *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 13 p (For primary document see N87-11180 02-39)
(Contract NAS3-23293)
Avail: NTIS HC A17/MF A01 CSCL 11F

N87-11193*# General Electric Co., Fairfield, Conn.
EFFECTS OF SURFACE CHEMISTRY ON HOT CORROSION LIFE
R. E. Fryxell and B. K. Gupta (TRW, Inc., Cleveland, Ohio) *In* NASA. Lewis Research Center Turbine Engine Hote Section Technology, 1984 Oct. 1984 14 p (For primary document see N87-11180 02-39)
(Contract NAS3-23926)
Avail: NTIS HC A17/MF A01 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N87-11006*# North Carolina State Univ., Raleigh. School of Textiles.
THE CRYSTALLIZATION OF TOUGH THERMOPLASTIC RESINS IN THE PRESENCE OF CARBON FIBERS Semiannual Progress Report, 1 Nov. 1985 - 1 May 1986
Michael H. Theil 1986 17 p
(Grant NAG1-525)
(NASA-CR-179810; NAS 1.26:179810) Avail: NTIS HC A02/MF A01 CSCL 11G

The crystallization kinetics of the thermoplastic resins poly (phenylene sulfide) (PPS) and poly(aryl-ether-ether-ketone) (PEEK) in the presence and in the abscence of carbon fibers was studied. How carbon fiber surfaces in composites affect the crystallization of tough thermoplastic polymers that may serve as matrix resins were determined. The crystallization kinetics of such substances can provide useful information about the crystallization mechanisms and, thus, indicate if the presence of carbon fibers cause any changes in such mechanisms. Author

N87-11007*# College of William and Mary, Williamsburg, Va.
CHARACTERIZATION OF THE RELATIONSHIP OF THE CURE CYCLE CHEMISTRY TO CURE CYCLE PROCESSING PROPERTIES Semiannual Report
David E. Kranbuehl 15 Aug. 1986 7 p
(Grant NAG1-237)
(NASA-CR-177058; NAS 1.26:177058) Avail: NTIS HC A02/MF A01 CSCL 11B

Dynamic Dielectric measurements made over a wide range of frequency provide a sensitive and convenient means for monitoring the cure process in thermosets and thermoplastics. The measurement of dielectric relaxation is one of only a few instrumental techniques available for studying molecular properties in both the liquid and solid states. Furthermore, it is probably the only convenient experimental technique for studying the polymerization process of going from a monomeric liquid of varying viscosity to a crosslinked, insoluble, high temperature solid. The objective of the research is to develop on-line dielectric instrumentation for quantitative nondestructive material evaluation and closed loop smart cure cycle control. The key is to relate the chemistry of the cure cycle process to the dielectric properties of the polymer system by correlating the time, temperature, and frequency dependent dielectric measurements with chemical characterization measurements. Measurement of the wide variation in magnitude of the complex permittivity with both frequency and state of cure, coupled with chemical characterization work, have been shown in the laboratory to have the potential to determine: resin quality, composition and age; cure cycle window boundaries; onset of flow and point of maximum flow; extent of and completion of reaction; evolution of volatiles; T sub g; and, crosslinking and molecular weight buildup. Author

N87-11008*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A NEW READILY PROCESSABLE POLYIMIDE
F. W. Harris (Akron Univ., Ohio), M. W. Beltz, and P. M. Hergenrother 1986 11 p
(NASA-TM-89253; NAS 1.15:89253) Avail: NTIS HC A02/MF A01 CSCL 11B

As part of an effort to develop tough solvent resistance thermoplastics for potential use as structural resins on aerospace vehicles, a new processable polyimide was evaluated. The synthesis involved the reaction of a new diamine, 1,3-bis 2-(3-aminophenoxy)ethyl ether, with 3,3',4,4'-benzophenonetetracarboxylic dianhydride to form the polyamic acid and subsequent conversion of it to the polyimide. Various physical properties such as thermal stability, solvent resistance, glass transition temperature, crystalline melt temperature, melt viscosity and mechanical properties such as fracture toughness, adhesive, film and composite properties are reported. Of particular interest is the extremely high titanium to titanium tensile shear strength obtained for this polyimide. Author

N87-11009*# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
PROCESSING OF LASER FORMED SiC POWDER Final Report, 30 Jul. 1982 - 31 Dec. 1985
J. S. Haggerty and H. K. Bowen 31 Dec. 1985 85 p
(Grant NAG3-312)
(NASA-CR-179857; NAS 1.26:179857) Avail: NTIS HC A05/MF A01 CSCL 11G

Superior SiC characteristics can be achieved through the use of ideal constituent powders and careful post-synthesis processing steps. High purity SiC powders of approx. 1000 A uniform diameter, nonagglomerated and spherical were produced. This required major revision of the particle formation and growth model from one based on classical nucleation and growth to one based on collision and coalescence of Si particles followed by their carburization. Dispersions based on pure organic solvents as well as steric stabilization were investigated. Although stable dispersions were formed by both, subsequent part fabrication emphasized the pure solvents since fewer problems with drying and residuals of the high purity particles were anticipated. Test parts were made by the colloidal pressing technique; both liquid filtration and consolidation (rearrangement) stages were modeled. Green densities corresponding to a random close packed structure (approx. 63%) were achieved; this highly perfect structure has a high, uniform coordination number (greater than 11) approaching the quality of an ordered structure without introducing domain boundary effects. After drying, parts were densified at temperatures ranging from 1800 to 2100 C. Optimum densification temperatures will probably be in the 1900 to 2000 C range based on these preliminary results which showed that 2050 C samples had experienced substantial grain growth. Although overfired, the 2050 C samples exhibited excellent mechanical properties. Biaxial tensile strengths up to 714 MPa and Vickers hardness values of 2430 kg/sq mm 2

were both more typical of hot pressed than sintered SiC. Both result from the absence of large defects and the confinement of residual porosity (less than 2.5%) to small diameter, uniformly distributed pores. Author

N87-11010*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF Ti-6Al-4V SURFACE TREATMENTS FOR USE WITH A POLYPHENYLQUINOXALINE ADHESIVE
Donald J. Progar Oct. 1986 20 p
(NASA-TM-89045; NAS 1.15:89045) Avail: NTIS HC A02/MF A01 CSCL 11B

Three surface treatments for Ti-6Al-4V adherends were evaluated using a thermoplastic polymer monoether polyphenylquinoxaline, MEPPQ, which had been shown in previous studies to have good potential as a high temperature adhesive for aerospace applications. Initial results based on long term thermal exposure at 232 C (450 F) using the phosphate-fluoride (PF) and chromic acid anodized (CAA) treatments with MEPPQ adhesive were not encouraging. A significant improvement in strength retention and a change in failure mode (cohesive) at 232 C (450F) was found for the SHA treated specimens compared to the PF and CAA treatments. Although an improvement in long term thermal durability was obtained with the SHA treatment of Ti-6Al-4V, an improved surface treatment with better long term durability is still required for aerospace applications. Author

N87-11011# Massachusetts Inst. of Tech., Cambridge.
EFFECTIVE CONDUCTIVITY OF AGING POLYURETHANE FOAM
L. R. Glicksman, A. G. Ostrogorsky, and S. Chiappetta Mar. 1986 64 p
(Contract DE-AC05-84OR-21400)
(DE86-008939; ORNL/Sub-84-9009/1) Avail: NTIS HC A04/MF A01

An experimental technique was developed to measure the permeability of the cell walls to air components. Cell walls obtained from large bubbles were used as samples. The large bubbles are found on the surface of free rise foam. Once cell wall permeability and cell geometry are known, the foam effective diffusion coefficient can be computed from a model developed earlier. An experimental technique was also developed to measure the effective permeability of the foam. Data were taken with N2, O2 and CO2 at different temperatures. Two simple laboratory tests were developed to measure the effectiveness of the diffusion barriers. A test cell was designed to measure the leakage rate through the open paths at the foam-foil interface. To be able to detect the open paths a simple dye technique was developed. It was found that most of the tested samples with foil on both sides have open paths at only one interface. On the other interface an open shear layer 1 to 2 mm below the interface was detected. DOE

N87-11012# Sandia National Labs., Albuquerque, N. Mex.
FRACTAL ASPECTS OF CERAMIC SYNTHESIS
D. W. Schaefer and K. D. Keefer 1986 12 p Presented at the Materials Research Society Spring Meeting, Palo Alto, Calif., 15 Apr. 1986
(Contract DE-AC04-76DP-00789)
(DE86-011657; SAND-85-2455C; CONF-860445-14) Avail: NTIS HC A02/MF A01

The concept of fractal geometry is used to describe the structure of silica polymers, colloidal aggregates, and critical systems. We illustrate the interpretation of scattering curves (X-ray, neutron and light) for fractal systems and review simple growth models which generate fractal structures. We describe the polymerization of silica under various conditions and demonstrate that, depending on chemical conditions, polymerization maps onto simple fractal growth processes. The key factors which control growth are monomer-cluster vs cluster-cluster growth, and reaction-limited vs diffusion-limited growth. DOE

N87-11013# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerforschung.
STRAIN RATE DEPENDENCE OF THE DEFORMATION BEHAVIOR OF POLYMERS AT LOW TEMPERATURES Thesis - Karlsruhe University, West Germany
Karl Poehlmann Feb. 1986 104 p In GERMAN; ENGLISH summary
(KfK-4060; ISSN-0303-4003; ETN-86-97836) Avail: NTIS HC A06/MF A01

The fracture behavior under tension of polymers was investigated at 77, 4.2 K in a wide range of strain rates. The time dependence of the fracture properties determined (fracture stress and fracture strain) can be correlated with the molecular dynamics of the polymers within the whole range examined. At very high strain rates thermal effects in microscopic zones (crazes) are necessary. These effects are estimated on the basis of thermodynamics considerations of the deformation processes in the craze. This estimation supports the proposed theoretical concept of the rate dependence of the fracture behavior. Qualitative conclusions are drawn from investigations of the fracture surfaces by scanning electron microscopy. A device to perform short-time tests at low temperatures with low expenditure in terms of time and cryoengineering is presented. ESA

N87-11194*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COATING LIFE PREDICTION
James A. Nesbitt and Michael A. Gedwill *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11G

N87-11195*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRODUCTION TO LIFE MODELING OF THERMAL BARRIER COATINGS
Robert A. Miller *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11G

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N87-11014# Federal Aviation Administration, Atlantic City, N.J.
AVGAS/AUTOGAS COMPARISON: WINTER FUELS Interim Report
Augusto M. Ferrara Jul. 1986 53 p
(DOT/FAA-CT-86/21) Avail: NTIS HC A04/MF A01

This report describes dynamometer tests which simulated conditions found in a general aviation aircraft. In these tests, automobile gasoline was tested and compared with aviation gasoline. The tendency for vapor lock and detonation was measured as a function of gasoline grade, Reid Vapor Pressure, and the age of the fuel. Author

N87-11015# Brookhaven National Lab., Upton, N. Y.
USE OF MOLTEN SALT ELECTROCHEMICAL TECHNIQUES TO STUDY AND CONTROL HYDROGEN STORAGE IN METAL HYDRIDES Final Report
R. A. Huggins, C. M. Luedecke, and G. Deublein Apr. 1986 25 p
(Contract DE-AC02-76CH-00016)
(DE86-011534; BNL-38057) Avail: NTIS HC A02/MF A01

The work during this year has both established and demonstrated the basic principles, both theoretical and experimental, involved in the proposed new approach to the understanding of the thermodynamic features underlying the pressures and capacities observed in the storage of hydrogen in ternary metal hydride

systems. These were demonstrated for three different magnesium alloy hydride families. DOE

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology.*

N87-11016# Aeritalia S.p.A., Torino (Italy). Space Systems Group.

BUBBLE DROP AND PARTICLE UNIT (BDPU) PROJECT Executive Summary Report

M. Briccarello Paris ESA 3 Oct. 1986 106 p

(Contract ESA-5968/84)

(BO-RP-AI-004; ESA-CR(P)-2220; ETN-86-98100) Avail: NTIS HC A06/MF A01

A modular facility for studying bubble, drop, and particle dynamics in liquid matrices in nonuniform fields of temperature and concentration; formation and dynamics of solidification fronts under the effect of temperature and concentration gradients; interaction between bubbles, drops and particles, and the advancing solidification front; and the fluid dynamics of levitated samples, solution growth, life science experiments, and electrophoresis is proposed. Design results, program aspects, and commercial factors are discussed. ESA

N87-11017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

ADVANCED METHOD FOR COMPUTING THE FLOW AROUND WINGS WITH REAR SEPARATION AND GROUND EFFECT

Klaus Jacob Jan. 1986 65 p

(DFVLR-FB-86-17; ISSN-017-1342; ETN-86-98276) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 21.50

A method for computing the subsonic flow around wings with moderate to high aspect ratio and low sweep at high angles of attack was improved by introducing the curved basic flow concept. It was extended to include the ground effect by utilizing the reflected image concept. The state of the art is presented, and theoretical results are compared with measurements. Conclusions concerning the scope of the method are drawn. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N87-11018# Army Lab. Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.

UV/OZONE CLEANING OF SURFACES Technical Progress Report

John R. Vig May 1986 50 p

(AD-A169024; SLCET-TR-86-6) Avail: NTIS HC A03/MF A01 CSCL 14/2

The UV/ozone methods, which is reviewed in this report, is an effective method of removing a variety of contaminants from surfaces. It is a simple-to-use dry process which is inexpensive to set up and operate. It can rapidly produce clean surfaces, in air or in a vacuum system, at ambient temperatures. Placing properly precleaned surface within a few millimeters of an ozone-producing UV source can produce clean surfaces in less than one minute. The technique can produce clean surfaces in less than one minute. The technique can produce near-atomically clean surfaces, as evidenced by Auger electron spectrosocpy (AES), electron spectroscopy for chemical analysis (ESCA), and ion scattering spectroscopy/secondary ion mass spectroscopy (ISS/SIMS) studies. Topics discussed include the variables of the process, the types for surfaces which have been cleaned successfully, the contaminants that can be removed, the construction of a UV ozone cleaning facility, the mechanism of the process, UV/ozone cleaning in vacuum systems, rate-enhancement techniques, safety consideration, effects of UV/ozone other than cleaning, and applications. GRA

N87-11019# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1985-4, 227/JULY-AUGUST

Claude Sevestre, ed. ESA Feb. 1986 63 p Transl. into ENGLISH of "La Recherche Aerospatiale, Bulletin Bimestriel, no. 1985-4" Paris, France, ONERA, Jul. Aug. 1985

(ESA-TT-960; ETN-86-97802) Avail: NTIS HC A04/MF A01; HC in English and original report in French available at ONERA, Paris, France FF 70

Computation of internal separated flows and shock wave-boundary layer interactions by viscous-inviscid interaction, numerical simulation of the response of an axial compressor to nonhomogeneous flows, adaptation of Neuber's theory to stress concentration in viscoplasticity, and static and dynamic analysis of cyclically symmetric structures are discussed. Also discussed is the prediction of the unsteady aerodynamic field around a DARRIEUS - type windmill, unsteady stall modeling in three dimensional flow, and interactive graphic display software. ESA

N87-11020# Rolls-Royce Ltd., Derby (England).

NET SHAPE FORMING: THE ROUTE TO LOW COST COMPONENTS. THE VIEW POINT OF THE AEROSPACE INDUSTRY

J. A. Moore 6 Mar. 1986 25 p Presented at Institution of Production Engineers Seminar, London, England, 21 Nov. 1985

(PNR-90306; ETN-86-98017) Avail: NTIS HC A02/MF A01

Aerospace products which give the most benefit from Nett and near Nett purchases, and where it is recognised that even though their volume may be low their value is extremely light, are discussed. Turbine blades, nozzle guide vanes, casings, rings, fabrications, and major rotating components are cited. ESA

N87-11021# National Bureau of Standards, Gaithersburg, Md.

JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 91, NUMBER 1, JANUARY-FEBRUARY 1986

Feb. 1986 44 p

(PB86-206364) Avail: NTIS HC A03/MF A01 CSCL 13B

The Journal of Research of the National Bureau of Standards, Volume 91, Number 1, January-February 1986 contains the following: Ruggedness Testing-Part I: Ignoring Interactions; Ruggedness Testing-Part II; Recognizing Interactions; Effect of Variables on pH Measurement in Acid-Rain-Like Solutions as Determined by Ruggedness Tests; An Interlaboratory Test of pH Measurements in Rainwater; Development of a Standard Reference Material for Rainwater Analysis. The Journal also advances features in measurement methodology and analyses consistent with the NBS responsibility as the nation's measurement science laboratory. It includes reports on instrumentation for making accurate and precise measurements in fields of physical science and engineering, as well as the mathematical models of phenomena which enable the predictive determination of information in regions where measurements may be absent. Papers on critical data, calibration techniques, quality assurance programs, and well characterized reference materials reflect NBS programs in these areas. GRA

N87-11028*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Ground Antennas and Facilities Engineering Section

STABILITY INVESTIGATION OF THE QUADRIPOD STRUCTURE FOR THE NASA/JPL 70-METER ANTENNA

C. T. Chian, J. J. Cucchissi, and R. Levy *In its* The Telecommunications and Data Acquisition Report (date] p 33 - 42 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 17B

N87-11503# Soziologisches Forschungsinst. e.V., Goettingen (West Germany).
MANUFACTURING PLANNING IN MACHINE BUILDING FROM THE POINT OF VIEW OF MANAGEMENT AND WORKSHOP PERSONNEL [FERTIGUNGSSTEUERUNG IM MASCHINENBAU AUS DER PERSPEKTIVE VON UNTERNEHMENSLEITUNG UND WERKSTATTPERSONAL]
F. Manske *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 85-109 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N87-11022 Royal Signals and Radar Establishment, Malvern (England).
SPECTRAL ANALYSIS FOR RADAR USING LINEAR PREDICTIVE FILTERING
J. F. Cross Nov. 1985 23 p
(RSRE-Memo-3896; BR98874; ETN-86-98006) Avail: NTIS HC A02

Spectral analysis (for pure sinusoids in white noise) using the covariance method of linear predictive filtering (LPF) was compared with discrete Fourier transformation (DFT). It is found to be advantageous to take the geometric mean of the power spectra produced from the forward and backward filters. Given this approach, the LPF method can match the detection performance of a windowed DFT for a single sinusoid in white noise. There is no evidence of spurious peak production, i.e., the false alarm probability does not increase above the noise-only case when signals are introduced. Above 10dB signal to noise ratio (SNR) improvements in resolution over a windowed DFT are observable and are small factor improvements rather than order of magnitude. At high SNR significant improvements in multiple signal detectability can be expected from the LPF method, with, however, a large computational increase over the DFT methods. ESA

N87-11023 Royal Signals and Radar Establishment, Malvern (England).
EXPERIMENTS ON THE ANNOTATION OF LARGE QUANTITIES OF SPEECH USING THE ZIP DYNAMIC TIME-WARPING ALGORITHM
S. M. Peeling Dec. 1985 22 p
(RSRE-Memo-3919; BR99177; ETN-86-98011) Avail: Issuing Activity

It is demonstrated that the ZIP algorithm is capable of perfect alignment of annotated and unannotated speech files in the majority of cases, even when the files are from different speakers. It can therefore form the basis of an automatic annotation system. It is unlikely that ZIP can completely remove the need for human inspection. However, in cases where misalignment occurs it frequently only affects a small portion of the two files so that a minimal amount of human correction is required. Experiments suggest that a reduced representation of two channels is adequate. For the particular 2 channel representation used, a beamwidth of 200 and deletion penalties of 15 are suitable parameters. By calculating the sum of the differences between the minimum scores in consecutive windows, and averaging this sum over the whole file it is possible to automatically determine the quality of the alignment. ESA

N87-11024*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Apr. - Jun. 1986
E. C. Posner, ed. 15 Aug. 1986 315 p
(Contract NAS7-918)
(NASA-CR-179715; JPL-TDA-PR-42-86; NAS 1.26:179715) Avail: NTIS HC A14/MF A01 CSCL 17B

This publication, one of a series formerly titled The Deep Space Network Progress Report, documents DSN progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations. In addition, developments in Earth-based radio technology as applied to geodynamics, astrophysics and the radio search for extraterrestrial intelligence are reported. For individual titles, see N87-11025 through N87-11055.

N87-11025*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
DSS 13 FREQUENCY STABILITY TESTS PERFORMED DURING MAY 1985 THROUGH MARCH 1986
T. Y. Otoshi and M. M. Franco *In its* The Telecommunications and Data Acquisition Report (date) p 1 - 14 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

Results of station frequency stability testing performed at DSS 13 (Deep Space Station) during May 1985 through March 1986 are presented. The testing was done on X-band uplink and X- and S-band downlink subsystems as well as on end-to-end systems. The subsystem test data are useful for assessing the frequency stability of various prototype X-band uplink or downlink subsystems for purposes of making design improvements. Information derived from extensive testing at DSS 13 will be useful in the preparation of an X-band Uplink Demonstration Experiment to be conducted at DSS 13, and will also be valuable in the preparations of gravity wave experiments to be conducted at other DSN stations in the future. Author

N87-11026*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Ground Antenna and Facilities Engineering Section.
NEW SHORT-TIME ALIGNMENT TECHNIQUE FOR 70-METER ANTENNA SURFACE PANELS
M. S. Katow *In its* The Telecommunications and Data Acquisition Report (date) p 15 - 25 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

With severely limited field modification time for upgrading the 64-m antenna to 70-m diameter, a new shorter time method for aligning the surface panels of the main reflector was needed. For each target on the surface panel, both distance (or range) and elevation angle measurements are made. A new technique for setting the surface panels at zenith look has been devised. This article describes the software required to convert the computed target distortions obtained from the JPL-IDEAS structural analysis computer program (defining the gravity load change from a 45-deg elevation angle to zenith look) into the theodolite reading at zenith look. The technique results in a perfectly shaped reflector at the 45-deg rigging elevation, with acceptable surface error tolerance. Author

N87-11027*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
A PROTOTYPE DSN X/S-BAND FEED: MODEL 3 DEVELOPMENT c33
D. A. Bathker and H. F. Reilly *In its* The Telecommunications and Data Acquisition Report (date) p 26 - 32 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

The development of a prototype X/S-band common aperture Cassegrain feedhorn for Deep Space Network (DSN) use is discussed. A Model 3 combiner has been developed to increase S-band bandwidth to include the Highly Elliptical Earth Orbiter band from 2025 to 2110 MHz, and to provide a 400-kW CW S-band uplink and a possible planetary radar band near 2320 MHz.

The combiner uses eight S-band waveguide injection slots arranged in four pairs. The problems of this design geometry associated with rejection filtering and X/S-band matching are discussed. M.G.

N87-11028*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Ground Antennas and Facilities Engineering Section
STABILITY INVESTIGATION OF THE QUADRIPOD STRUCTURE FOR THE NASA/JPL 70-METER ANTENNA c31
C. T. Chian, J. J. Cucchissi, and R. Levy *In its* The Telecommunications and Data Acquisition Report (date] p 33 - 42 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

A new, slim-profiled, low-blockage quadripod structure was designed to support the 7.7-m-diameter subreflector for the 70-m antenna. Detailed analyses of quadripod structural stability (in frequency and buckling) are presented. The results indicate that the new quadripod design has an adequate safety margin for buckling, and its lowest natural frequency is above the control system bandwidth. The analytical design frequencies were confirmed by actual field measurements made in Spain in February 1986. Author

N87-11029*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
ARRAY FEED SYNTHESIS FOR CORRECTION OF REFLECTOR DISTORTION AND VERNIER BEAMSTEERING
S. J. Blank and W. A. Imbriale *In its* The Telecommunications and Data Acquisition Report (date] p 43 - 55 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

An algorithmic procedure for the synthesis of planar array feeds for paraboloidal reflectors is described which simultaneously provides electronic correction of systematic reflector surface distortions as well as a Vernier electronic beamsteering capability. Simple rules of thumb for the optimum choice of planar array feed configuration (i.e., number and type of elements) are derived from a parametric study made using the synthesis procedure. A number of f/D ratios and distortion models were examined that are typical of large paraboloidal reflectors. Numerical results are presented showing that, for the range of distortion models considered, good on-axis gain restoration can be achieved with as few as seven elements. For beamsteering to +/- 1 beamwidth (BW), 19 elements are required. For arrays with either 7 or 19 elements, the results indicate that the use of high-aperture-efficiency elements (e.g., disk-on-rod and short backfire) in the array yields higher system gain than can be obtained with elements having lower aperture efficiency (e.g., open-ended waveguides). With 37 elements, excellent gain and beamsteering performance to +/- 1.5 BW are obtained independent of the assumed effective aperture of the array element. An approximate expression is derived for the focal-plane field distribution of the distorted reflector. Contour plots of the focal-plane fields are also presented for various distortion and beam scan angle cases. The results obtained show the effectiveness of the array feed approach. Author

N87-11030*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
THE 1- TO 4-K REFRIGERATION TECHNIQUES FOR COOLING MASERS ON A BEAM WAVEGUIDE ANTENNA
D. L. Johnson *In its* The Telecommunications and Data Acquisition Report (date] p 56 - 65 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

The status of technology is reported for various 1- to 4-K commercially available refrigeration systems capable of producing 1.5-K refrigeration to cool masers and superconducting cavity oscillators on the proposed beam waveguide antenna. The design requirements for the refrigeration system and the cryostat are presented. A continuously operating evaporation refrigerator that uses capillary tubing to provide a continuous, self-regulating flow of helium at approximately 1.5 K has been selected as the first refrigerator design for the beam waveguide antenna. Author

N87-11031*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communication Systems Research Section.
SINGLE LONGITUDINAL MODE OPERATION OF SEMICONDUCTOR LASER ARRAYS WITH ETALON CONTROL c36
H. Hemmati *In its* The Telecommunications and Data Acquisition Report (date] p 66 - 69 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

A simple method is devised to obtain a single longitudinal output beam from high-power multilongitudinal mode diode laser arrays. Mode control is achieved by simply placing a thin etalon in front of the laser. The three-cavity laser formed by addition of the etalon favors a single longitudinal mode. This technique is applicable to both continuous wave and pulsed laser modes of operation. Experimental results demonstrating the technique along with future work and possible applications are discussed. Author

N87-11032*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A RECURSIVE SOLUTION FOR A FADING MEMORY FILTER DERIVED FROM KALMAN FILTER THEORY c33
J. I. Statman *In its* The Telecommunications and Data Acquisition Report (date] p 70 - 76 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

A simple recursive solution for a class of fading memory tracking filters is presented. A fading memory filter provides estimates of filter states based on past measurements, similar to a traditional Kalman filter. Unlike a Kalman filter, an exponentially decaying weight is applied to older measurements, discounting their effect on present state estimates. It is shown that Kalman filters and fading memory filters are closely related solutions to a general least squares estimator problem. Closed form filter transfer functions are derived for a time invariant, steady state, fading memory filter. These can be applied in loop filter implementation of the Deep Space Network (DSN) Advanced Receiver carrier phase locked loop (PLL). Author

N87-11033*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
AN ESTIMATOR-PREDICTOR APPROACH TO PLL LOOP FILTER DESIGN c33
J. I. Statman and W. J. Hurd *In its* The Telecommunications and Data Acquisition Report (date] p 77 - 89 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

An approach to the design of digital phase locked loops (DPLLs), using estimation theory concepts in the selection of a loop filter, is presented. The key concept is that the DPLL closed-loop transfer function is decomposed into an estimator and a predictor. The estimator provides recursive estimates of phase, frequency, and higher order derivatives, while the predictor compensates for the transport lag inherent in the loop. This decomposition results in a straightforward loop filter design procedure, enabling use of techniques from optimal and sub-optimal estimation theory. A design example for a particular choice of estimator is presented, followed by analysis of the associated bandwidth, gain margin, and steady state errors caused by unmodeled dynamics. This approach is under consideration for the design of the Deep Space Network (DSN) Advanced Receiver Carrier DPLL. Author

N87-11034*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
CHOOSING CHANNEL QUANTIZATION LEVELS AND VITERBI DECODING FOR SPACE DIVERSITY RECEPTION OVER THE ADDITIVE WHITE GUASSIAN NOISE CHANNEL
S. Kalson *In its* The Telecommunications and Data Acquisition Report (date] p 90 - 94 (For primary document see N87-11024

02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

Previous work in the area of choosing channel quantization levels for a additive white Gaussian noise channel composed of one receiver-demodulator is reviewed, and how this applies to the Deep Space Network composed of several receiver-demodulators (space diversity reception) is shown. Viterbi decoding for the resulting quantized channel is discussed. Author

N87-11035*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
PHASE LOCK ACQUISITION FOR SAMPLED DATA PLLS USING THE SWEEP TECHNIQUE c33
S. Aguirre, D. H. Brown, and W. J. Hurd *In its* The Telecommunications and Data Acquisition Report (date] p 95 - 102 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

Simulation results of the swept-acquisition performance of residual carrier phase-locked loops (PLLs) are reported. The loops investigated are sampled data counterparts of the continuous time type II and III loops currently in use in Deep Space Network receivers. It was found that sweep rates of 0.2 B(sub L)(2) to 0.4 B(sub L)(2) Hz/s can be used, depending on the loop parameters and loop signal-to-noise ratio (SNR), where B(sub L) is the one-sided loop noise bandwidth. Type III loops are shown to be not as reliable as type II loops for acquisition using this technique, especially at low SNRs. Author

N87-11036*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A METHOD TO DRAMATICALLY IMPROVE SUBCARRIER TRACKING
W. J. Hurd and S. Aguirre *In its* The Telecommunications and Data Acquisition Report (date] p 103 - 110 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 20N

A method is presented for achieving a dramatic improvement in phase tracking of square wave subcarriers or other square waves. The method is to set the amplitude of the phase quadrature reference signal to zero except near the zero crossings of the input signal. Without changing the loop bandwidth, the variance of the phase error can be reduced to approximately W sigma(sub 0)(2), were sigma (sub 0)(2) is the phase error variance without windowing, and W is the fraction of cycle in which the reference signal has a nonzero value. Simulation results confirm the analysis and establish minimum W versus signal-to-noise ratio. Typically, the window can be made so narrow as to achieve a phase error variance of 1.5 sigma(sub 0)(4). Author

N87-11037*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A NEW METHOD FOR FRAME SYNCHRONIZATION
M. Shahshahani and L. Swanson *In its* The Telecommunications and Data Acquisition Report (date] p 111 - 123 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

A frame synchronization method based on an examination of the shortest bit length containing all error bursts is introduced. It is shown that the new method is more reliable and efficient than the commonly used one based on counting the number of errors for the convolutionally coded channel. Author

N87-11038*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
CRAMER-RAO BOUNDS FOR SIGNAL-TO-NOISE RATIO AND COMBINER WEIGHT ESTIMATION
S. J. Dolinar *In its* The Telecommunications and Data Acquisition Report (date] p 124 - 130 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

Cramer-Rao lower bounds on estimator variance are calculated for arbitrary unbiased estimates of signal-to-noise ratio and combiner weight parameters. Estimates are assumed to be based on a discrete set of observables obtained by matched filtering of a biphase modulated signal. The bounds are developed first for a problem model based on one observable per channel symbol period, and then extended to a more general problem in which subperiod observables are also available. Author

N87-11039*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
ANTENNA ARRAYING OF VOYAGER TELEMETRY SIGNALS BY SYMBOL STREAM COMBINING c17
W. J. Hurd, J. Rabkin, M. D. Russell, B. Siev, H. W. Cooper, T. O. Anderson, and P. U. Winter *In its* The Telecommunications and Data Acquisition Report (date) p 131 - 142 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09F

Telemetry signals received from the Voyager 2 spacecraft at Deep Space Stations at Parkes and Canberra, Australia, on February 6, 1986, were combined by the method of symbol stream combining. This second demonstration of symbol stream combining followed the International Cometary Explorer (ICE) demonstration at Giacobini-Zinner encounter in September 1985. The Voyager demonstration was at a symbol rate of 43.2 ksymb/s, compared to 2 ksymb/s for ICE. Recording, playback, and combining at this higher rate were demonstrated. The average symbol signal-to-noise ratio (SNR) of the combined data was 2.84 dB, or 0.23 dB less than the sum of the SNRs of the two imput symbol streams. This 0.23 loss from ideal combining was due to use of 4-bit quantization of the input symbol stream and imperfect scaling. A practical implementation with 8-bit quantization could achieve combining losses of under 0.05 dB over a wide dynamic range of input signal levels. Author

N87-11040*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A VLSI ARCHITECTURE FOR PERFORMING FINITE FIELD ARITHMETIC WITH REDUCED TABLE LOOK-UP c33
I. S. Hsu, T. K. Truong, and I. S. Reed *In its* The Telecommunications and Data Acquisition Report (date] p 143 - 154 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

A new table look-up method for finding the log and antilog of finite field elements has been developed by N. Glover. In his method, the log and antilog of a field element is found by the use of several smaller tables. The method is based on a use of the Chinese Remainder Theorem. The technique often results in a significant reduction in the memory requirements of the problem. A VLSI architecture is developed for a special case of this new algorithm to perform finite field arithmetic including multiplication, division, and the finding of an inverse element in the finite field. Author

N87-11041*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A NEW VLSI COMPLEX INTEGER MULTIPLIER WHICH USES A QUADRATIC-POLYNOMIAL RESIDUE SYSTEM WITH FERMAT NUMBERS c33
T. K. Truong, I. S. Hsu, J. J. Chang, H. C. Shyu, and I. S. Reed *In its* The Telecommunications and Data Acquisition Report (date] p 155 - 163 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

A quadratic-polynomial Fermat residue number system (QFNS) has been used to compute complex integer multiplications. The advantage of such a QFNS is that a complex integer multiplication requires only two integer multiplications. In this article, a new type Fermat number multiplier is developed which eliminates the initialization condition of the previous method. It is shown that the new complex multiplier can be implemented on a single VLSI chip. Such a chip is designed and fabricated in CMOS-pw technology. Author

N87-11042*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.

UNATTENDED DEEP SPACE STATION TRACKING STATION DEVELOPMENT: MONITOR AND CONTROL TECHNOLOGY **c14**

C. Foster *In its* The Telecommunications and Data Acquisition Report (date] p 164 - 170 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 22D

The major developments leading to successful demonstration of fully unattended operation of a Deep Space Network (DSN) station (DSS 13) are reviewed. Unattended operation was demonstrated by reliably tracking, commanding, and delivering telemetry from the Pioneer 8 spacecraft. Transfer of automated monitor and control technology to DSN implementation is summarized, along with related accomplishments. Author

N87-11043*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.

A SYSTEM FOR THE FUNCTIONAL TESTING AND SIMULATION OF CUSTOM AND SEMICUSTOM VLSI CHIPS **c33**

E. M. Olson and L. J. Deutsch *In its* The Telecommunications and Data Acquisition Report (date] p 171 - 180 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09A

A system for the functional testing and simulation of custom and semicustom very large scale integrated (VLSI) chips that are designed using the integrated UNIX-based computer-aided design (CAD) system is described. The testing and simulation system consists of two parts. One of these is a special purpose hardware device that is capable of controlling the digital imputs and outputs on a custom chip. This device, the Digital Microcircuit Functionality Tester (DMFT) system, can be operated by itself or in conjunction with the VAX host computer on the CAD system. The DMFT is integrated into a microprobe station so that these signals can be injected or read from nodes inside the chip, as well as at the pins. The second part of the system is a software package that is installed on the VAX. This software package, logic, includes a full-screen editor for developing chip test sequences and drivers for both the DMFT and the esim logic simulator. Author

N87-11044*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.

PROTOTYPING AND IMPLEMENTING FLIGHT QUALIFIABLE SEMICUSTOM CMOS P-WELL BULK INTEGRATED CIRCUITS IN THE JPL ENVIRONMENT **c33**

E. M. Olson *In its* The Telecommunications and Data Acquisition Report (date] p 181 - 192 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09A

Presently, there are many difficulties associated with implementing application specific custom or semi-custom (standard cell based) integrated circuits (ICs) into JPL flight projects. One of the primary difficulties is developing prototype semi-custom integrated circuits for use and evaluation in engineering prototype flight hardware. The prototype semi-custom ICs must be extremely cost-effective and yet still representative of flight qualifiable versions of the design. A second difficulty is encountered in the transport of the design from engineering prototype quality to flight quality. Normally, flight quality integrated circuits have stringent quality standards, must be radiation resistant and should consume minimal power. It is often not necessary or cost effective, however, to impose such stringent quality standards on engineering models developed for systems analysis in controlled lab environments. This article presents work originally initiated for ground based applications that also addresses these two problems. Furthermore, this article suggests a method that has been shown successful in prototyping flight quality semi-custom ICs through the Metal Oxide Semiconductor Implementation Service (MOSIS) program run by the University of Southern California's Information Sciences Institute. The method has been used successfully to design and fabricate through the MOSIS three different semi-custom prototype CMOS p-well chips. The three designs make use of the work presented and were designed consistent with design techniques and structures that are flight qualifiable, allowing one hour transfer of the design from engineering model status to flight qualifiable foundry-ready status through methods outlined in this article. Author

N87-11045*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Microelectronics Technology Section.

ULYSSES: A FUNCTIONAL DESCRIPTION AND SIMULATION SOFTWARE SYSTEM **c61**

T. W. Griswold and D. F. Hendry *In its* The Telecommunications and Data Acquisition Report (date] p 193 - 202 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09B

Current design tools for digital circuits and systems are not well-integrated among the behavioral, gate, and transistor levels of design. Ulysses is a prototype software system that consists of a description language, a description compiler, and a simulator that make no distinction among these levels. The language is uniform over the entire range of logical descriptions, the description is hierarchical with no fundamental restrictions on depth or mixing of levels, and the simulator is fully integrated with the description. The structure of the language, compiler, and simulator are described in terms of their relationships to the abstractions of physical systems that are made in order to create logical descriptions and models of behavior. Author

N87-11046*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Telecommunications Systems Section.

IMPROVED PERFORMANCE OF A DIGITAL PHASE-LOCKED LOOP COMBINED WITH A FREQUENCY/FREQUENCY-RATE ESTIMATOR **c33**

A. Mileant and M. Simon *In its* The Telecommunications and Data Acquisition Report (date] p 203 - 215 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09C

When a digital phase-locked loop with a long loop update time tracks a signal with high Doppler, the demodualtion losses due to frequency mismatch can become very significant. One way of reducing these Doppler-related losses is to compensate for the Doppler effect using some kind of frequency-rate estimator. The performance of the fixed-window least-squares estimator and the Kalman filter is investigated; several Doppler compensating techniques are proposed. It is shown that the variance of the frequency estimator can be made as small as desired, and with this, the Doppler effect can be effectively compensated. The remaining demodulation losses due to phase jitter in the loop can be less than 0.1 dB. Author

N87-11047*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.

VLA FEEDHORN FOR VOYAGER ENCOUNTER OF NEPTUNE **c33**

F. Manshadi, D. A. Bathker, and H. W. Marlin *In its* The Telecommunications and Data Acquisition Report (date] p 216 - 226 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09C

A high gain, low noise corrugated feedhorn was designed and developed by JPL for use in Very Large Array (VLA) antennas, near Soccoro, New Mexico. The new feedhorn will enable the VLA to support the Voyager encounter of Neptune in August of 1989. This will significantly enhance the receiving capability of the United States for that historic event. Author

N87-11048*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.

X-BAND PREAMPLIFIER FILTER **c33**

F. Manshadi *In its* The Telecommunications and Data Acquisition Report (date] p 227 - 230 (For primary document see N87-11024 02-32)

Avail: NTIS HC A14/MF A01 CSCL 09C

A low-loss bandstop filter designed and developed for the

Deep Space Network's 34-meter high-efficiency antennas is described. The filter is used for protection of the X-band traveling wave masers from the 20-kW transmitter signal. A combination of empirical and theoretical techniques was employed as well as computer simulation to verify the design before fabrication. Author

N87-11049*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
PHYSICAL OPTICS ANALYSIS OF A 4-REFLECTOR ANTENNA, PART 2 **c74**
A. G. Cha *In its* The Telecommunications and Data Acquisition Report (date] p 231 - 243 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 20F

The results of a rigorous analysis of the Deep Space Network (DSN) 70-m antenna S-band (2.295-GHz) RF performance are presented. Previous estimation of 1.6 dB S-band gain improvement of the 70-m antenna over the 64-m antenna has been revised to 1.5 dB by this analysis. The S-band right circularly polarized (RCP) beam position offset relative to X-band (8.45-GHz) beam position is predicted to be 0.0045 deg. (0.04 beamwidth). The effective S-band gain loss resulting from non-coincidence with the X-band is predicted to be 0.02 dB. Therefore, this is no longer a concern for the 64-m to 70-m upgrade project. Author

N87-11050*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
FINITE WORDLENGTH IMPLEMENTATION OF A MEGACHANNEL DIGITAL SPECTRUM ANALYZER **c33**
E. H. Satorius, M. J. Grimm, G. A. Zimmerman, and H. C. Wilck *In its* The Telecommunications and Data Acquisition Report (date] p 244 - 254 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09A

The results of an extensive system analysis of the megachannel spectrum analyzer currently being developed for use in various applications of the Deep Space Network are presented. The intent of this analysis is to quantify the effects of digital quantization errors on system performance. The results of this analysis provide useful guidelines for choosing various system design parameters to enhance system performance. Author

N87-11051*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. TDA Engineering Office.
DEEP SPACE NETWORK MARK 4A DESCRIPTION
R. J. Wallace and R. W. Burt *In its* The Telecommunications and Data Acquisition Report (date] p 255 - 260 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

The general system configuration for the Mark 4A Deep Space Network is described. The arrangement and complement of antennas at the communications complexes and subsystem equipment at the signal processing centers are described. A description of the Network Operations Control Center is also presented. Author

N87-11052*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Navigation Systems Section.
HEO MULTIMISSION NAVIGATION CONCEPT
J. Ellis *In its* The Telecommunications and Data Acquisition Report (date] p 261 - 267 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

As part of the Network Consolidation Program, the 26-meter Tracking and Communication Subnet was transferred to JPL. Along with this transfer JPL assumed responsibility for tracking and navigation support for Earth orbiter missions normally tracked by the 26-meter sites. The High Earth Orbiter (HEO) Multimission Navigation Facility was formed as a component of the Deep Space Network (DSN) Tracking System for the purpose of supporting Earth orbiter missions and certain classes of deep space missions. This facility has been implemented on a dedicated VAX 11/780 minicomputer within the Network Operations Control Center (NOCC). The primary function of the system is to process radio metric data and estimate the orbit of a spacecraft in near-Earth or deep space environment. The system is capable of processing radio metric data in near-real time and providing the quick turnaround required for Earth orbiter operations. It is also capable of generating precision spacecraft ephemeris for use by the NOCC Support Subsystem and external agencies. This article discusses the implementation and functional operation of the Multimission Navigation Subsystem and describes the support that has been provided for an array of missions. Author

N87-11053*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Navigation Systems Section.
ICE NAVIGATION SUPPORT **c90**
L. Efron, R. J. Muellerschoen, and R. I. Premkumar *In its* The Telecommunications and Data Acquisition Report (date] p 268 - 283 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03B

The International Cometary Explorer (ICE) encounter with Comet Giacobini-Zinner took place 7 years after the spacecraft's original launch on 12 August 1978 as the International Sun Earth Explorer 3 (ISEE-3), part of a three-spacecraft project to study the interaction between the solar wind and the Earth's magnetosphere. Transfer to an interplanetary trajectory was performed via a 119-km-altitute, gravity-assist, lunar swingby on December 1983. Navigation support during interplanetary cruise and comet encounter was provided by orbit determination utilizing radio metric data from the DSN 64-meter antennas in Goldstone, California and Madrid, Spain. Orbit solutions yielding predictions of 50-km geocentric delivery accuracy in the target aim plane were achieved during interplanetary cruise and at comet encounter using 6-to-12-week data arcs between periodic attitude-change maneuvers. One-sigma two-way range and range rate residuals were consistently 40 meters and 0.2 mm/s or better, respectively. Nongravitational forces affected the comet's motion during late August and early September 1985 and caused a 2300-km shift in the orbit of the comet relative to the spacecraft. This necessitated a final ICE orbit trim maneuver 3 days prior to encounter. Near-real-time assessment of two-way 2-GHz (S-band) Doppler pseudo-residuals during the June and July 1985 trajectory change maneuvers aided in calibration of the spacecraft's thrusters in preparation for this final critical maneuver. Post-flight analysis indicates tail centerline passage was achieved within 10 seconds of the predicted time and geocentric position uncertainty at encounter was less than 40 km. M.G.

N87-11054*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Space Physics and Astrophysics Section.
OBJECTIVES AND FIRST RESULTS OF THE NASA SETI SKY SURVEY FIELD TESTS AT GOLDSTONE **c89**
S. Gulkis, M. J. Klein, E. T. Olsen, R. B. Crow, R. M. Gosline, G. S. Downs, M. P. Quirk, A. Lokshin, and J. Solomon *In its* The Telecommunications and Data Acquisition Report (date] p 284 - 300 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03A

Field tests of SETI (Search for Extraterrestrial Intelligence) prototype hardware and software began in March 1985 at Goldstone. With emphasis on the sky survey component of the NASA SETI search strategy, the article describes the survey characteristics, the detection strategy, and preliminary results of system tests. Author

N87-11055*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Tracking Systems and Applications Section.
DEMONSTRATION OF THE FIDUCIAL CONCEPT USING DATA FROM THE MARCH 1985 GPS FIELD TEST **c43**
J. M. Davidson, C. L. Thornton, S. A. Stephens, S.-C. Wu, S. M. Lichten, J. S. Border, O. J. Sovers, T. H. Dixon, and B. G. Williams *In its* The Telecommunications and Data Acquisition Report (date] p 301 - 306 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03A

The first field test of NASA's Global Positioning System (GPS) Geodetic Program took place in March of 1985. The principal objective of this test was the demonstration of the feasibility of

the fiducial station approach to precise GPS-based geodesy and orbit determination. Other objectives included an assessment of the performance of the several GPS receiver types involved in these field tests and the testing of the GIPSY software for GPS data analysis. In this article, the GIPSY (GPS Inferred Positioning System) software system is described and baseline solutions are examined for consistency with independent measurements made using very long baseline interferometry. Author

N87-11056*# IGI Consulting, Inc., Boston, Mass.
US LONG DISTANCE FIBER OPTIC NETWORKS: TECHNOLOGY, EVOLUTION AND ADVANCED CONCEPTS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Oct. 1986 56 p
(Contract NAS3-24682)
(NASA-CR-179479; NAS 1.26:179479) Avail: NTIS HC A04/MF A01 CSCL 17B

Over the past two decades, fiber optics has emerged as a highly practical and cost-efficient communications technology. Its competitiveness vis-a-vis other transmission media, especially satellite, has become a critical question. This report studies the likely evolution and application of fiber optic networks in the United States to the end of the century. The outlook for the technology of fiber systems is assessed and forecast, scenarios of the evolution of fiber optic network development are constructed, and costs to provide service are determined and examined parametrically as a function of network size and traffic carried. Volume 1 consists of the Executive Summary. Volume 2 focuses on fiber optic technology and long distance fiber optic networks. Volume 3 develops a traffic and financial model of a nationwide long distance transmission network. Among the study's most important conclusions are: revenue requirements per circuit for LATA-to-LATA fiber optic links are less than one cent per call minute; multiplex equipment, which is likely to be required in any competing system, is the largest contributor to circuit costs; the potential capacity of fiber optic cable is very large and as yet undefined; and fiber optic transmission combined with other network optimization schemes can lead to even lower costs than those identified in this study. Author

N87-11057*# IGI Consulting, Inc., Boston, Mass.
US LONG DISTANCE FIBER OPTIC NETWORKS: TECHNOLOGY, EVOLUTION AND ADVANCED CONCEPTS. VOLUME 2: FIBER OPTIC TECHNOLOGY AND LONG DISTANCE NETWORKS Final Report
Oct. 1986 151 p
(Contract NAS3-24682)
(NASA-CR-179480; NAS 1.26:179480) Avail: NTIS HC A08/MF A01 CSCL 17B

The study projects until 2000 the evolution of long distance fiber optic networks in the U.S. Volume 1 is the Executive Summary. Volume 2 focuses on fiber optic components and systems that are directly related to the operation of long-haul networks. Optimistic, pessimistic and most likely scenarios of technology development are presented. The activities of national and regional companies implementing fiber long haul networks are also highlighted, along with an analysis of the market and regulatory forces affecting network evolution. Volume 3 presents advanced fiber optic network concept definitions. Inter-LATA traffic is quantified and forms the basis for the construction of 11-, 15-, 17-, and 23-node networks. Using the technology projections from Volume 2, a financial model identifies cost drivers and determines circuit mile costs between any two LATAs. A comparison of fiber optics with alternative transmission concludes the report. Author

N87-11058# Department of the Air Force, Washington, D.C.
TROPOSPHERIC SCATTER COMMUNICATION SYSTEM HAVING ANGLE DIVERSITY Patent
Philip D. Kaplan, inventor (to Air Force) Issued 14 Jan. 1986 6 p Supersedes AD-D011448
(AD-D012263; US-Patent-4,564,935; US-Patent-Appl-SN-569644; US-Patent-Class-370-38) Avail: US Patent and Trademark Office CSCL 17/2

A tropospheric scatter communication system provides diverse angle transmission paths which may be utilized alone or in conjunction with frequency and/or other known diversity system arrangements for improved performance. The diverse angle transmission paths are routed through sum and difference monopulse beams displaced in azimuth. Author (GRA)

N87-11059# Syracuse Univ., N. Y.
ELECTROMAGNETIC FIELD-TO-WIRE COUPLING IN THE SHF/EHF FREQUENCY RANGE Final Technical Report, May - Oct. 1985
A. T. Adams, Jose Perini, M. Miyabayashi, D. H. Shau, and K. Heidary Mar. 1986 91 p
(Contract F30602-81-C-0169)
(AD-A168083; RADC-TR-86-28) Avail: NTIS HC A05/MF A01 CSCL 20/14

A feasibility study has been conducted to examine methods of treating field-to-wire coupling in the SHF/EHF frequency range. In this region, transmission line lengths and wire separations become very large electrically, and field-to-wire coupling problems become intractable. Several types of transmission lines have been examined in the SHF/EHF range, including uniform and non-uniform transmission lines, coaxial transmission lines, and multi-conductor transmission lines. Current distributions are predominantly of the standing-wave or traveling-wave form. The higher order modes are not significant for those cases examined. Rounds may be obtained for induced currents in the field-to-wire problem by considering the transmission line as an antenna and using the equivalent circuit of the receiving antenna which has been extended to multiport receivers. A method has thus been outlined for treating transmission lines at SHF/EHF. GRA

N87-11060# Aerospace Corp., El Segundo, Calif.
MILLIMETER-WAVE RANGE FOR THE QUICK EVALUATION OF LARGE REFLECTOR ANTENNAS WITH COMPLEX FEEDS
Steven Lazar, Howell B. Dyson, and Albert Leong 1 Apr. 1986 17 p
(Contract F04701-85-C-0086)
(AD-A168161; TR-0086(6925-06)-1; SD-TR-86-19) Avail: NTIS HC A02/MF A01 CSCL 14/2

An automated millimeter-wave antenna range capable of measuring primary-feed structure patterns and transferring this data to a mainframe computer for secondary pattern computation is described. Its applicability to the rapid evaluation of complex feed structures as used in a Cassegrain antenna is illustrated. An example of a reflector antenna analysis is compared to a measured pattern. GRA

N87-11061# Illinois Univ., Urbana. Dept. of Electrical and Computer Engineering.
A STUDY OF MICROSTRIP ANTENNAS FOR MULTIPLE BAND AND HIGH FREQUENCY OPERATIONS Final Report, Nov. 1981 - Sep. 1984
Y. T. Lo, S. M. Wright, W. F. Richards, and B. F. Wang Mar. 1986 322 p
(Contract F19628-82-K-0005)
(AD-A169011; UILU-EM-84-15; RADC-TR-86-8) Avail: NTIS HC A14/MF A01 CSCL 09/5

This report consists of four parts. Part 1 is on an Efficient Analysis of Infinite Microstrip Arrays on Electricity Thick Substrates. The emphasis is placed on a numerically efficient method. The analysis also includes the case of infinite arrays with printed dipoles. Part 2 is an extension of the previous work on multiple port microstrip antennas. Experiments were carried out, which showed that this improved theory could predict the loading effect at the second port at the resonant frequency of the input port very accurately. Part 3 is devoted to the theory and experiment of single element dual-frequency microstrip antennas. The main objective is to achieve a dual-frequency operation for the same linear polarization with a single element fed at one port. This is discussed in Part 4. GRA

N87-11062# University of Southern California, Los Angeles.
RESEARCH ISSUES IN POWER CONDITIONING: A WORKSHOP HELD AT LOS ANGELES, CALIFORNIA ON 3-4 DECEMBER 1985 Final Report, 1 Dec. 1985 - 30 Jun. 1986
Martin Gundersen 2 May 1986 96 p Workshop held in Los Angeles, Calif., 3-4 Dec. 1985
(Contract MIPR-ARO-117-86; Grant AF-AFOSR-0044-86)
(AD-A169268; ARO-23483.1-PH-CF) Avail: NTIS HC A05/MF A01 CSCL 10/2

The workshop was organized to address a problem that has arisen in the area of pulsed power, or power conditioning research. The problem is the development of a gap between applied physics research that deals with fundamental device physics, and the development of improved pulsed power devices. The purpose of the workshop was to work to change an impedance mismatch, and foster communication between research and pulsed power engineering. GRA

N87-11063# Naval Ocean Systems Center, San Diego, Calif.
PROPAGATION OF SIGNALS IN THE FREQUENCY BAND BETWEEN 30 MHz AND 100 MHz Final Report, Oct. 1984 - Sep. 1985
W. Powers and R. B. Rose Sep. 1985 99 p
(AD-A169332; NOSC/TR-1087) Avail: NTIS HC A05/MF A01 CSCL 20/14

Propagation in the LoVHF (30 to 100 MHz) frequency band possesses characteristics common to both HF (3 to 30 MHz) and HiVHF (100 to 300 MHz) propagation. It is this feature which makes this frequency band both interesting and complex. The primary interest of this report is the modes of propagation between surface- or near-surface-based transmitters and receivers. For a given range, the strength, geographical and temporal dependence, and likelihood of a particular mode of propagation will be discussed. In the last section, various existing models that could be used to describe the field strength and transmission loss in the LoVHF band are assessed. These models and the discussion of the various modes of propagation fall roughly into two groups: (1) those that affect ranges less than 500 km, and (2) those that affect ranges greater than 500 km. GRA

N87-11064# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Software Technology.
VERIFICATION OF TWO COMMUNICATION PROTOCOLS BY MEANS OF PROCESS ALGEBRA M.S. Thesis - Leiden Univ.
Frits W. Vaandrager Jan. 1986 79 p Submitted for publication Sponsored by European Economic Commission ESPRIT Project 432
(CWI-CS-R8608; B8664607; ETN-86-97758) Avail: NTIS HC A05/MF A01

A Positive Acknowledgement with Retransmission protocol, and a One Bit Sliding Window protocol are verified in the framework of the algebra of communicating processes with silent steps, augmented with additional axioms. The Cluster Fair Abstraction Rule (CFAR) a generalization of Koomen's Fair Abstraction Rule (KFAR) is presented and it is shown that CFAR can be derived from KFAR. The notion of redundancy in a context, which makes it possible to use trace theoretic arguments in process algebra calculations is introduced. For the verification of the second protocol, the technique of local replacement is used. In this technique, a concurrent system is simplified by repeated replacement of components, replacements which leave the behavior of the system invariant. ESA

N87-11065# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
REGULATIONS, CRITERIA, AND MEASUREMENT PRACTICE FOR SUSCEPTIBILITY CRITERIA
C. Wagemaker 9 May 1984 16 p In DUTCH; ENGLISH summary Presented at PATO Course on Electromagnetic Compatibility (EMC), Eindhoven, Netherlands, 13-24 Nov. 1984
(NLR-MP-84089-U; B8664363; ETN-86-98031) Avail: NTIS HC A02/MF A01

Procedures for electromagnetic susceptibility tests were developed in order to guarantee objectivity. The regulations drawn up by the different interest groups are given. The different ways in which susceptibility measurements are performed are described. The choice of test signal levels is discussed. ESA

N87-11066# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
OFFSET UNFURLABLE ANTENNA. PHASE 2A: EXECUTIVE SUMMARY
Paris ESA Nov. 1985 34 p
(Contract ESTEC-5206/82-NL-PB(SC))
(MBB-R-0200/3069-R; ESA-CR(P)-2199; ETN-86-98085) Avail: NTIS HC A03/MF A01

A 4.5 m radial rib reflector was designed for the 4 GHz Intelsat mission. The reflector was redesigned for the M-Sat 2-beam coverage requirements, resulting in a 5 m dia, 850 MHz offset reflector. It features a radial carbon fiber rib concept where foldable main ribs and intermediate ribs tension a gold plated molybdenum mesh to the required surface contour. The accuracy is varied by applying different numbers of ribs (e.g., 16 for 850 MHz or 30 for 12 GHz) and mesh fastening points. The electrical performance criteria used to establish the acceptable mechanical tolerances is that the level of the gore lobes generated by the ribs remains at least 30 dB below the main beam peak under all orbital conditions. ESA

N87-11067# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
ANALYSIS OF DIRECTIONAL COUPLER SIGNALS IN AN OVERMODED WAVEGUIDE SYSTEM
G. Janzen Mar. 1985 28 p
(IPF-85-2; ETN-86-98254) Avail: NTIS HC A03/MF A01

Electric wave fields inside and outside a reflective and lossy microwave transmission line system, as used for electron cyclotron resonance heating of plasmas, are described. The waveguide system is defined by the complex reflection coefficients of two discontinuities leading to accumulated fields, which are measured and analyzed by mode selective directional couplers. The total resonator Q of the loaded waveguide system is calculated and related to the reflection coefficients of the inhomogeneities. ESA

N87-11068# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
COMPONENTS FOR TRANSMISSION OF VERY HIGH POWER MM WAVES (200 kW AT 28, 70 AND 140 GHz) IN OVERMODED CIRCULAR WAVEGUIDES
M. Thumm, V. Erckmann, W. Kasparek, H. Kumric, G. A. Mueller, P. G. Schueller, and R. Wilhelm Mar. 1986 17 p Presented at Mikrowellentechnologie und Optoelektronik (MIOP) 1986 Fachmesse und Konferenz fuer Hoechstfrequenztechnologie, Wiesbaden, West Germany, 10-12 Jun. 1986
(IPF-86-2; ETN-86-98256) Avail: NTIS HC A02/MF A01

Optimized overmoded circular waveguide components of transmission lines developed for high-power (200 kW) millimeter wave applications at 28, 70, and 140 GHz, as e.g., electron cyclotron resonance heating of plasmas for thermonuclear fusion research with gyrotrons, are described. Axisymmetric, narrow, pencil-like beams with well-defined polarization (HE11 hybrid mode) are used at open-ended corrugated waveguide antennas. The HE11 mode is generated from TE0n gyrotron modes by multistep mode conversion: TE0n yields T001 yields TE11 yields HE11 or TE0n yields TE01 yields TM11 yields HE11. Analyses and measurements on mode transducer systems of the first type at 28 and 70 GHz and of the second type at 140 GHz are reported. In all cases the overall efficiency of the complete mode conversion sequence in the desired mode is 92% to 95%. Mode purity in the transmission lines is conserved by using corrugated gradual waveguide bends with optimized curvature distribution and diameter tapers with nonlinear contours. Highly efficient corrugated-wall mode selective filters decouple the different waveguide sections. Mode content and reflected powere are determined by a k-spectrometer. Absolute power calibration is done with calorimetric loads using an organic absorbing fluid. ESA

N87-11069# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Geofysisch Onderzoek.
SOME CONSIDERATIONS OF WAVE PROPAGATION [ENKELE BESCHOUWINGEN OVER GOLFVOORTPLANTING]
P. L. F. M. Verdonk 1986 97 p In DUTCH; ENGLISH summary (KNMI-WR-86-2(GO); B8666192; ISSN-0169-1651; ETN-86-98502) Avail: NTIS HC A05/MF A01

The meaning of group velocity and its relation to conserved quantities are demonstrated. The origin of wave dispersion in terms of nonlocal and relaxation phenomena are clarified. The character of a wave described by an equation with a general type of nonlinearity and general dispersion terms is explained. The steepening of a wave flank and the occurrence of stationary waves are discussed. ESA

N87-11070# Federal Communications Commission, Washington, D. C. Land Mobile Radio/UHF Television Tech. Adv. Comm.
LAND MOBILE RADIO/UHF TELEVISION TECHNICAL ADVISORY COMMITTEE FINAL REPORT IN THE MATTER OF FURTHER SHARING OF THE UHF TELEVISION BAND BY PRIVATE LAND MOBILE RADIO SERVICES Final Report
W. Torak 7 May 1986 124 p
(PB86-206562) Avail: NTIS HC A06/MF A01 CSCL 17B

On May 31, 1985, the Federal Communications Commission adopted a Notice of Proposed Rule Making (Notice) in General Docket No. 85-172 looking toward the use of UHF television spectrum in eight cities throughout the United States by eligible users in the Private Land Mobile Radio Services. Simultaneously, it adopted a Memorandum Opinion and Order (MO&O) in the Docket No. 85-173 proceeding establishing a Land Mobile/UHF Television Technical Advisory Committee to provide assistance to the Commission regarding the possibility of additional land mobile use of UHF television channels. The Report is the work product of the Technical Advisory Committee (TAC) established by the FCC in the Docket No. 85-173 proceeding. GRA

N87-11256# National Aerospace Lab., Amsterdam (Netherlands).
SIMULATION OF MULTITEMPORAL SAR IMAGES
G. J. L. Nooren *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 111-116 (For primary document see N87-11238 02-43)
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A25/MF A01

N87-11257# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE EFFECT OF ELECTROMAGNETIC WAVE POLARIZATION ON WAVE ATTENUATION IN A VEGETATION CANOPY [EFFET DE LA POLARISATION D'UNE ONDE ELECTROMAGNETIQUE DANS L'ATTENUATION DE L'ONDE DANS UN COUVERT VEGETAL]
A. Lopes and T. Le-Toan *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 117-122 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11258# Universite Catholique de Louvain (Belgium). Lab. de Telecommunications et d'Hyperfrequences.
A TRANSLATION PROPERTY IN ROUGH SURFACE SCATTERING
A. Guissard *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 123-125 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11259# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
EXPERIMENTS ON MODELING RADAR BACKSCATTER OF FOREST STANDS AND RESEARCH ON CLASSIFICATION
D. H. Hoekman *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 127-132 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11260# Texas Univ., Arlington. Wave Scattering Research Center.
SPACEBORNE SAR DEPOLARISATION AMBIGUITIES
A. J. Blanchard and D. Lukert *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 133-136 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11261# Centre National d'Etudes Spatiales, Toulouse (France).
WIND TUNNEL INVESTIGATION OF THE CHARACTERIZATION OF RADAR BACKSCATTERING BY DIFFERENT WAVE FIELDS [ETUDE EN SOUFFLERIE DE LA CARACTERISATION DE LA RETRODIFFUSION RADAR PAR DIFFERENTS CHAMPS EN VOGUE]
A. Liefermann, A. Ramamonjiarisoa, and B. Jahne (Heidelberg Univ., West Germany) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 137-140 In FRENCH Sponsored by CNES, GRGS, and Inst. Francais de la Recherche pour l'Exploitation de la Mer (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N87-11071 Royal Signals and Radar Establishment, Malvern (England).
SILICON WAFER CLEANING FOR INTEGRATED CIRCUIT FABRICATION
R. W. Hardeman and A. M. Hodge 25 Nov. 1985 21 p
(RSRE-Memo-3907; BR98724; ETN-86-98009) Avail: NTIS HC A02

Silicon wafers cleaned using different immersion methods were compared. The surfaces so produced were assessed. Results obtained after using these cleans are shown to be consistent with those described in the literature. The optimum clean is found to be that described by RCA (1970). This was adopted as a standard procedure and results are encouraging. ESA

N87-11072*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1985 GODDARD SPACE FLIGHT CENTER BATTERY WORKSHOP
G. Morrow, ed. Sep. 1986 427 p Workshop held in Greenbelt, Md., 19-21 Nov. 1985
(NASA-CP-2434; Rept-86B0366; NAS 1.55:2434) Avail: NTIS HC A19/MF A01 CSCL 10C

The subjects covered include: advanced energy storage, lithium cell technology, nickel-cadmium design evaluation and component testing, simulated orbital cycling and flight experience, and nickel-hydrogen technology. For individual titles, see N87-11073 through N87-11103.

N87-11073*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA LEWIS EVALUATION OF REGENERATIVE FUEL CELL (RFC) SYSTEMS
N. H. Hagedorn, O. D. GonzalezSanabria, and L. L. Kohout *In*

NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 13-18 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Evaluation of two regenerative fuel cell (RFC) systems was begun in-house, and under contracts and grants. The passive hydrogen-oxygen RFC offers the possibility of a high-energy density, long-life storage system for geosynchronous Earth orbit missions. The hydrogen-bromine RFC offers the combination of high efficiency and moderate energy density that could ideally suit low Earth orbit missions if successfully developed. Either or both of these systems would be attractive additions to the storage options available to designers of future missions. B.G.

N87-11074*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Aerospace Power Div.
SODIUM-SULFUR BATTERIES FOR SPACECRAFT ENERGY STORAGE
Ross E. Dueber *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 19 - 30 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Power levels for future space missions will be much higher than are presently attainable using nickel-cadmium and nickel-hydrogen batteries. Development of a high energy density rechargeable battery is essential in being able to provide these higher power levels without tremendous weight penalties. Studies conducted by both the Air Force and private industry have identified the sodium-sulfur battery as the best candidate for a next generation battery system. The advantages of the sodium-sulfur battery over the nickel-cadmium battery are discussed. Author

N87-11075*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
ENERGY STORAGE SYSTEMS COMPARISON FOR THE SPACE STATION
G. vanOmmering *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 31 - 40 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

An overview of the requirements, options, selection criteria and other considerations, and current status with regard to the energy storage subsystem (ESS) for the photovoltaic power system alternative for the space station is provided. Author

N87-11076*# Honeywell Power Sources Center, Horsham, Pa.
GALILEO LI/SO SUB 2 BATTERY MODULES PROGRAM UPDATE
R. A. Smith *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 43 - 65 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

In order to meet the power needs of NASA's Galileo Probe, the Li/SO2 high rate D cells used in the battery modules have undergone some design changes, as upgrading of hardware quality requirements, and significant testing. A description of the design changes and the cell test data that are of a general nature is presented here. This data includes capacities, open circuit voltages, and internal resistance comparisons. A significant data base was built up over the years and continues to grow. Author

N87-11077*# Naval Surface Weapons Center, Silver Spring, Md.
DETERMINING THE INFLUENCE AND EFFECTS OF MANUFACTURING VARIABLES ON SULFUR DIOXIDE CELLS
W. V. Zajac, M. A. Thomas, J. A. Barnes, R Bis, F., P. B. Davis, F. C. DeBold, G. W. Gemmill, and L. A. Kowalchik *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 67 - 74 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A survey of the Li/SO2 manufacturing community was conducted to determine where variability exists in processing. The upper and lower limits of these processing variables might, by themselves or by interacting with other variables, influence safety, performance, and reliability. A number of important variables were identified and a comprehensive design experiment is being proposed to make the proper determinations. Author

N87-11078*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SAFETY HAZARDS ASSOCIATED WITH THE CHARGING OF LITHIUM/SULFUR DIOXIDE CELLS
H. Frank, G. Halpert, D. D. Lawson, J. A. Barnes (Naval Surface Weapons Center, Silver Spring, Md.), and R. F. Bis *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 75 - 92 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A continuing research program to assess the responses of spirally wound, lithium/sulfur dioxide cells to charging as functions of charging current, temperature, and cell condition prior to charging is described. Partially discharged cells that are charged at currents greater than one ampere explode with the time to explosion inversely proportional to the charging current. Cells charged at currents of less than one ampere may fail in one of several modes. The data allows an empirical prediction of when certain cells will fail given a constant charging current. Author

N87-11079*# Electrochem Industries, Inc., Clarence, N.Y.
SAFETY CONSIDERATIONS FOR FABRICATING LITHIUM BATTERY PACKS
James J. Ciesla *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 93 - 106 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Lithium cell safety is a major issue with both manufacturers and end users. Most manufacturers have taken great strides to develop the safest cells possible while still maintaining performance characteristics. The combining of lithium cells for higher voltages, currents, and capacities requires the fabricator of lithium battery packs to be knowledgable about the specific electrochemical system being used. Relatively high rate, spirally wound (large surface area) sulfur oxychloride cells systems, such as Li/Thionyl or Sulfuryl chloride are considered. Prior to the start of a design of a battery pack, a review of the characterization studies for the cells should be conducted. The approach for fabricating a battery pack might vary with cell size. Author

N87-11080*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HEAT DISSIPATION OF HIGH RATE LI-SOCI SUB 2 PRIMARY CELLS
Young I. Cho, Gerald Halpert, and E. Deligiannis *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 107 - 116 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The heat dissipation problem occurring in the lithium thionyl chloride cells discharged at relatively high rates under normal discharge conditions is examined. Four heat flow paths were identified, and the thermal resistances of the relating cell components along each flow path were accordingly calculated. From the thermal resistance network analysis, it was demonstrated that about 90 percent of the total heat produced within the cell should be dissipated along the radial direction in a spirally wound cell. In addition, the threshold value of the heat generation rate at which cell internal temperature could be maintained below 100 C, was calculated from total thermal resistance and found to be 2.9 W. However, these calculations were made only at the cell components' level, and the transient nature of the heat accumulation and dissipation was not considered. A simple transient model based on the lumped-heat-capacity concept was developed to predict the time-dependent cell temperature at different discharge rates. The overall objective was to examine the influence of cell design variable from the heat removal point of view under normal discharge

conditions and to make recommendations to build more efficient lithium cells. Author

N87-11081*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TEST RESULTS OF JPL LISOCl SUB 2 CELLS
G. Halpert, S. Subbarao, S. Dawson, V. Ang, and E. Deligiannis *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 117 - 130 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

In the development of high rate Li-SO-Cl2 cells for various applications, the goal is to achieve 300 watt-hours per kilogram at the C/2 (5 amp) rate in a D cell configuration. The JPL role is to develop the understanding of the performance, life, and safety limiting characteristics in the cell and to transfer the technology to a manufacturer to produce a safe, high quality product in a reproducible manner. The approach taken to achieve the goals is divided into four subject areas: cathode processes and characteristics; chemical reactions and safety; cell design and assembly; and performance and abuse testing. The progress made in each of these areas is discussed. Author

N87-11082*# Moli Energy Ltd., Burnaby (British Columbia).
A 65 Ah RECHARGEABLE LITHIUM MOLYBDENUM DISULFIDE BATTERY
K. Brandt *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 131 - 144 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A rechargeable lithium molybdenum disulfide battery which has a number of superior performance characteristics which includes a high energy density, a high power density, and a long charge retention time was developed. The first cell sizes developed included a C size cell and an AA size cell. Over the last two years, a project to demonstrate the feasibility of the scale up to this technology to a BC size cell with 65 Ah capacity was undertaken. The objective was to develop, build, and test a .6 kWh storage battery consisting of 6 BC cells in series. Author

N87-11083*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXAMINATION OF DESIGN OPTIONS FOR 35 Ah AMBIENT TEMPERATURE LI-TIS SUB 2 CELLS
D. H. Shen, S. Subba Rao, S. P. S. Yen, and R. B. Somoano *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 145 - 155 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The Jet Propulsion Laboratory is actively engaged in the development of ambient temperature rechargable lithium cells for future NASA geosynchronous Earth orbit (GEO) missions. To achieve these ambitious goals, Li-TiS2, Li-MoS3, and Li-V6O13 systems were examined in detail. Among these three, the Li-TiS2 system has shown the longest life cycle and highest rate capability. Experimental Li-TiS2 batteries (10.5 V, 0.4 Ah) developed in-house have completed eight simulated and accelerated GEO seasons successfully. Inview of the encouraging results, the design options were examined for a scaled-up Li-TiS2 cell. It is hoped that the results of these studies will provide guidelines for prioritizing the research efforts and guiding the selection of optimized materials. Designs for 35 Ah Li-TiS2 cell were examined because present day geosynchronous satellites are powered by batteries of 35 Ah capacity. A computer program was developed to evaluate the influence of various design parameters on the specific energy and the rate capability of the cells. B.G.

N87-11084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUALIFICATION TESTING OF GENERAL ELECTRIC 50 Ah NICKEL-CADMIUM CELLS WITH NEW SEPARATOR AND NEW POSITIVE PLATE PROCESSING
George W. Morrow *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 159 - 168 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Forty-two 50 Ah aerospace nickel-cadmium cells were delivered to Goddard Space Flight Center (GSFC) by General Electric (GE) in February, 1985, for the purpose of evaluating and qualifying a new nylon separator material Pellon 2536, and the new GE Positive Plate Nickel Attack Control Passivation process. Testing began in May, 1985, at the Naval Weapons Support Center (NWSC) in Crane, Indiana with standard initial evaluation tests. Life cycling in both Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO) began in July, 1985, with approximately 1200 LEO cycles complete at this writting. Early test results show that cells with positive plate passivation exhibit higher than normal charge voltage characteristics. Other aspects of performance were nominal. Author

N87-11085*# Aerospace Corp., El Segundo, Calif.
AEROSPACE NICKEL-CADMIUM CELL SEPARATOR QUALIFICATIONS PROGRAM
R. W. Francis and R. L. Haag (Naval Weapons Support Center, Crane, Ind.) *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 169 - 176 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The present space qualified nylon separator, Pellon 2505 ML, is no longer available for aerospace nickel-cadmium (NiCd) cells. As a result of this anticipated unavailability, a joint Government program between the Air Force Space Division and the Naval Research Laboratory was established. Four cell types were procured with both the old qualified and the new unqualified separators. Acceptance, characterization, and life cycling tests are to be performed at the Naval Weapons Support Center, Crane, Ind. (NWSC/Crane). The scheduling and current status of this program are discussed and the progress of testing and available results are projected. Author

N87-11086*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FLOODED-STARVED DESIGN FOR NICKEL-CADMIUM CELLS
Lawrence H. Thaller *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 177 - 184 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A somewhat analogous situation among groupings of alkaline fuel cells is described where the stochastic aspects were much more accurately documented and then it was illustrated how this problem was eliminated using straight forward principles of pore size engineering. This is followed by a suggested method of adapting these same design principles to nickel-cadmium cells. It must be kept in mind that when cells are cycled to typically twenty percent depth of discharge that eighty percent of the weight of the cell is simply dead weight. Some of this dead weight might be put to better use by trading it for a scheme that would increase the time during which the cell would be working more closely to its optimum set of operating parameters. Author

N87-11087*# Eagle-Picher industries, Inc., Joplin, Mo.
AN ADVANCED Ni-Cd BATTERY CELL DESIGN
Lee Miller *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 185 - 194 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The evolution of an advanced Ni-Cd space battery cell design continues to prove very promising. High oxygen/hydrogen gas recombination rates (currently up to a C/5 charge rate) and increased electrolyte activation level tolerance (currently up to 5.6 grams Ah of positive capacity) were demonstrated by test. A superior performance, extended life battery cell offering advantages should soon be available for mission applications Author

N87-11088*# Aerospace Corp., Los Angeles, Calif.
SELF-DISCHARGE CHARACTERISTICS OF SPACECRAFT NICKEL-CADMIUM CELLS AT ELEVATED TEMPERATURES
S. W. Donley, J. H. Matsumoto, and W. C. Hwang *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 195 - 214 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The effects of heat generation were determined in NiCd cells during high temperature storage on open circuits. The testing was designed to determine the extent to which thermal stability is a valid concern, at temperature of exposure (externally effected) between 40 and 120 C. B.G.

N87-11089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELING Ni-Cd PERFORMANCE. PLANNED ALTERATIONS TO THE GODDARD BATTERY MODEL
James M. Jagielski *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 217 - 248 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The Goddard Space Flight Center (GSFC) currently has a preliminary computer model to simulate a Nickel Cadmium (Ni-Cd) performance. The basic methodology of the model was described in the paper entitled Fundamental Algorithms of the Goddard Battery Model. At present, the model is undergoing alterations to increase its efficiency, accuracy, and generality. A review of the present battery model is given, and the planned charges of the model are described. Author

N87-11090*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF LONG TERM STORAGE EFFECTS ON AEROSPACE NICKEL-CADMIUM CELL PERFORMANCE
Thomas Y. Yi *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 249 - 254 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A study on evaluation of the long term storage effects on aerospace nickel-cadmium cells currently being performed at NASA/Goddard Space Flight Center (GSFC) is described. A number of cells of 6 Ah and 12 Ah capacities which were stored in shorted condition for 8 to 9 years at the GSFC were selected for this study. These cells will undergo electrical acceptance testing the the GSFC, and life cycling at the NASA Battery Test Facility at the Naval Weapons Facility at the Naval Weapons Support Center (NWSC) in Crane, Indiana; in addition, some cells from the study will undergo destructive analyses. Author

N87-11091*# Naval Weapons Support Center, Crane, Ind.
SATELLITE BATTERY TESTING STATUS
Randy Haag and Steve Hall *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 255 - 266 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Because of the large numbers of satellite cells currently being tested and anticipated at the Naval Weapons Support Center (NAVWPNSUPPCEN) Crane, Indiana, satellite cell testing is being integrated into the Battery Test Automation Project (BTAP). The BTAP, designed to meet the growing needs for battery testing at the NAVWPNSUPPCEN Crane, will consist of several Automated Test Stations (ATSs) which monitor batteries under test. Each ATS will interface with an Automation Network Controller (ANC) which will collect test data for reduction. Author

N87-11092*# Martin Marietta Aerospace, Denver, Colo.
VOLTAGE-TEMPERATURE CHARGE VERIFICATION TESTING OF 34 AMPERE-HOUR NICKEL-CADMIUM CELLS
Paul J. Timmerman and Donald W. Bondeson *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 267 - 284 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

This testing was designed to evaluate various voltage-temperature (V-T) charge curves for use in low-Earth-orbit (LEO) applications of nickel-cadmium battery cells. The trends established relating V-T level to utilizable capacity were unexpected. The trends toward lower capacity at higher V-T levels was predominant in this testing. This effect was a function of the V-T level, the temperature, and the cell history. This effect was attributed to changes occurring in the positive plate. The results imply that for some applications, the use of even lower V-T levels may be warranted. The need to limit overcharge, especially in the early phases of missions, is underlined by this test program. Author

N87-11093*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NOAA 26.5 Ah LEO CHARACTERIZATION TEST
George W. Morrow *In its* The 1985 Goddard Space Flight Center Battery Workshop (date) p 285 - 303 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The General Electric (GE) 26.5 Ah NOAA-G flight nickel-cadmium cells were obtained from RCA-Astro Electronics to undergo performance characterization testing at the Goddard Space Flight Center (GSFC). This lot of cells was manufactured with passivated positive plate, to control nickel structure attack duing active material impregnation, and less electrolyte than normal (less than 3cc/Ah). The cells were tested in a parametric low Earth orbit (LEO) cycling regime that was previously used to test and characterize standard 50 Ah cells. Life cycle testing at the Naval Weapons Support Center (NWSC), in Crane, followed. The results of the test showed nominal performance in comparison with previous test data on the standard 50. Life cycle testing in the NOAA orbital regime is continuing at NWSC. Author

N87-11094*# Canadian Astronautics Ltd., Ottawa (Ontario).
A HIGH RELIABILITY BATTERY MANAGEMENT SYSTEM
Malcolm H. Moody *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 305 - 315 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Over a period of some 5 years Canadian Astronautics Limited (CAL) has developed a system to autonomously manage, and thus prolong the life of, secondary storage batteries. During the development, the system was aimed at the space vehicle application using nickel cadmium batteries, but is expected to be able to enhance the life and performance of any rechargeable electrochemical couple. The system handles the cells of a battery individually and thus avoids the problems of over, and under, drive that inevitably occur in a battery of cells managed by an averaging system. This individual handling also allow cells to be totally bypassed in the event of failure, thus avoiding the losses associated with low capacity, partial short circuit, and the catastrophe of open circuit. The system has an optional capability of managing redundant batteries simultaneously, adding the advantage of on line reconditioning of one battery, while the other maintains the energy storage capability of the overall system. As developed, the system contains a dedicated, redundant, microprocessor, but the capability exists to have this computing capability time shared, or remote, and operating through a data link. As adjuncts to the basic management system CAL has developed high efficiency, polyphase, power regulators for charge and discharge power conditioning. Author

N87-11095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT ADVANCES IN NI-H2 TECHNOLOGY AT NASA LEWIS RESEARCH CENTER
Olga D. GonzalezSanabria, Doris L. Britton, John J. Smithrick, and Margaret A. Reid *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 319 - 328 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The NASA Lewis Research Center has concentrated its

efforts on advancing the Ni-H2 system technology for low Earth orbit applications. Component technology as well as the design principles were studied in an effort to understand the system behavior and failure mechanisms in order to increase performance and extend cycle life. The design principles were previously addressed. The component development is discussed, in particular the separator and nickel electrode and how these efforts will advance the Ni-H2 system technology. Author

N87-11096*# Canadian Astronautics Ltd., Ottawa (Ontario).
LIGHTWEIGHT, DIRECT-RADIATING NICKEL HYDROGEN BATTERIES
John R. Metcalfe *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 329 - 348 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Two battery module configurations were developed which, in addition to integrating cylindrical nickel hydrogen (NiH2) cells into batteries, provide advances in the means of mounting, monitoring and thermal control of these cells. The main difference between the two modules is the physical arrangement of the cells: vertical versus horizontal. Direct thermal radiation to deep space is accomplished by substituting the battery structure for an exterior spacecraft panel. Unlike most conventional nickel-cadmium (NiCd) and NiH2 batteries, the cells are not tightly packed together; therefore ancillary heat conducting media to outside radiating areas, and spacecraft deck reinforcements for high mass concentration are not necessary. Testing included electrical characterization and a comprehensive regime of environmental exposures. The designs are flexible with respect to quantity and type of cells, orbit altitude and period, power demand profile, and the extent of cell parameter monitoring. This paper compares the characteristics of the two battery modules and summarizes their performance. Author

N87-11097*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF NICKEL HYDROGEN BATTERY TECHNOLOGY FOR THE RADARSAT SPACECRAFT
D. A. McCoy and J. L. Lackner (Defence Research Establishment, Ottawa, Ontario) *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 349 - 360 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The low Earth orbit (LEO) operations of the RADARSAT spacecraft require high performance batteries to provide energy to the payload and platform during eclipse period. Nickel Hydrogen cells are currently competing with the more traditional Nickel Cadmium cells for high performance spacecraft applications at geostationary Earth orbit (GEO) and Leo. Nickel Hydrogen cells appear better suited for high power applications where high currents and high Depths of Discharge are required. Although a number of GEO missions have flown with Nickel Hydrogen batteries, it is not readily apparent that the LEO version of the Nickel Hydrogen cell is able to withstand the extended cycle lifetime (5 years) of the RADARSAT mission. The problems associated with Nickel Hydrogen cells are discussed in the contex of RADARSAT mission and a test program designed to characterize cell performance is presented. Author

N87-11098*# Martin Marietta Aerospace, Denver, Colo.
NICKEL-HYDROGEN LOW-EARTH-ORBIT TEST PROGRAM
Joseph K. McDermott *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 361 - 371 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The incorporation of nickel-hydrogen technology for low-Earth-orbit spacecraft applications requires the establishment of a data base. An extensive test program was established to provide this data base. The test program is outlined and the preliminary test programs is presented. Author

N87-11099*# RCA Astro-Electronics Div., Princeton, N. J.
IMPACT OF SHUTTLE ENVIRONMENT ON PRELAUNCH HANDLING OF NICKEL-HYDROGEN BATTERIES
Robert S. Green *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 373 - 376 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Deployment of the American Satellite Company 1 spacecraft for the Space Shuttle Discovery in August 1985 set a new milestone in nickel-hydrogen battery technology. This communications satellite is equipped with two 35 Ah nickel-hydrogen batteries and it is the first such satellite launched into orbit via the Space Shuttle. The prelaunch activities, combined with the environmental constraints onboard the Shuttle, led to the development of a new battery handling procedure. An outline of the prelaunch activities, with particular attention to battery charging, is presented. Author

N87-11100*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PARAMETRIC TESTS OF A 40-Ah BIPOLAR NICKEL-HYDROGEN BATTERY
Robert L. Cataldo *In its* The 1985 Goddard Space Flight Center Battery Workshop (date] p 377 - 386 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A series of tests were performed to characterize battery performance relating to certain operating parameters which include charge current, discharge current, temperature, and pressure. The parameters were varied to confirm battery design concepts and to determine optimal operating conditions. Author

N87-11101*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
NICKEL-HYDROGEN BATTERIES FROM INTELSAT 5 TO SPACE STATION
G. vanOmmering and A. Z. Applewhite *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 387 - 397 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

The heritage of the Ni-H2 technology that makes the space station application feasible is discussed. It also describes a design for a potential space station Ni-H2 battery system. Specific design values presented here were developed by Ford Aerospace as part of the Rocketdyne team effort on the Phase B Definition and Preliminary Design of the Space Station Power System in support of NASA Lewis Research Center. Author

N87-11102*# Aerospace Corp., El Segundo, Calif.
NICKEL HYDROGEN LOW EARTH ORBIT LIFE TESTING
C. C. Badcock and R. L. Haag (Naval Weapons Support Center, Crane, Ind.) *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 399 - 410 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

A program to demonstrate the long term reliability of NiH2 cells in low Earth orbits (LEO) and support use in mid-altitude orbits (MAO) was initiated. Both 3.5 and 4.5 inch diameter nickel hydrogen cells are included in the test plan. Cells from all U.S. vendors are to be tested. The tests will be performed at -5 and 10 C at 40 and 60% DOD for LEO orbit and 10 C and 80% DOD for MAO orbit simulations. The goals of the testing are 20, 000 cycles at 60% DOD and 30,000 cycles at 40% DOD. Cells are presently undergoing acceptance and characterization testing at Naval Weapons Systems Center, Crane. Author

N87-11103*# Eagle-Picher Industries, Inc., Joplin, Mo.
THE 4.5 INCH DIAMETER IPV Ni-H2 CELL DEVELOPMENT PROGRAM
Lee Miller *In* NASA. Goddard Space Flight Center The 1985 Goddard Space Flight Center Battery Workshop (date) p 411 - 417 (For primary document see N87-11072 02-33)
Avail: NTIS HC A19/MF A01 CSCL 10C

Interest in larger capacity Ni-H2 battery cells for space applications has resulted in the initiation of a development/

qualification/production program. Cell component design was completed and component hardware fabricated and/or delivered. Finished cell design projections demonstrate favorable specific energies in the range of 70 to 75 Whr/Kg (32 to 34 Whr/Lb) for capacities of 100 to 250 Ah. It is further planned during this effort to evaluate the advanced cell design technology which has evolved from the work conducted at the NASA/Lewis Research Center.
Author

N87-11104*# Texas Instruments, Inc., Dallas. Central Research Labs.
THE 20 GHz GaAs MONOLITHIC POWER AMPLIFIER MODULE DEVELOPMENT Annual Report, 18 May 1983 - 17 May 1984
7 Jun. 1984 66 p
(Contract NAS3-23781)
(NASA-CR-179830; NAS 1.26:179830) Avail: NTIS HC A04/MF A01 CSCL 09A

The development of a 20 GHz GaAs FET monlithic power amplifier module for advanced communication applications is described. Four-way power combing of four 0.6 W amplifier modules is used as the baseline approach. For this purpose, a monolithic four-way traveling-wave power divider/combiner was developed. Over a 20 GHz bandwidth (10 to 30 GHz), an insertion loss of no more than 1.2 dB was measured for a pair of back-to-back connected divider/combiners. Isolation between output ports is better than 20 dB, and VSWRs are better than 21:1. A distributed amplifier with six 300 micron gate width FETs and gate and drain transmission line tapers has been designed, fabricated, and evaluated for use as an 0.6 W module. This amplifier has achieved state-of-the-art results of 0.5 W output power with at least 4 dB gain across the entire 2 to 21 GHz frequency range. An output power of 2 W was achieved at a measurement frequency of 18 GHz when four distributed amplifiers were power-combined using a pair of traveling-wave divider/combiners. Another approach is the direct common-source cascading of three power FET stages. An output power of up to 2W with 12 dB gain and 20% power-added efficiency has been achieved with this approach (at 17 GHz). The linear gain was 14 dB at 1 W output. The first two stages of the three-stage amplifier have achieved an output power of 1.6 W with 9 dB gain and 26% power-added efficiency at 16 GHz.
Author

N87-11105*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND DEVELOPMENT OF A MULTIBEAM 1.4 GHz PUSHBROOM MICROWAVE RADIOMETER
R. W. Lawrence, M. C. Bailey, R. F. Harrington, C. P. Hearn, J. G. Wells, and W. D. Stanley (Old Dominion Univ., Norfolk, Va.) Sep. 1986 65 p
(NASA-TM-89005; NAS 1.15:89005) Avail: NTIS HC A04/MF A01 CSCL 09C

The design and operation of a multiple beam, digital signal processing radiometer are discussed. The discussion includes a brief description of each major subsystem and an overall explanation of the hardware requirements and operation. A series of flight tests was conducted in which sea-truth sites, as well as an existing radiometer were used to verify the Pushbroom Radiometer performance. The results of these tests indicate that the Pushbroom Radiometer did meet the sensitivity design goal of 1.0 kelvin, and exceeded the accuracy requirement of 2.0 kelvin. Additional performance characteristics and test results are also presented.
Author

N87-11106# Department of the Air Force, Washington, D.C.
WAVELENGTH SELECTIVE DEMULTIPLEXER TUNER Patent
Charles R. Husbands, inventor (to Air Force) Issued 18 Feb. 1986 5 p Supersedes AD-D011890
(AD-D012264; US-Patent-4,571,024; US-Patent-Appl-SN-545307; US-Patent-Class-350-96.19) Avail: US Patent and Trademark Office CSCL 20/6

A wavelength selective demultiplexer tuner having an optically transmissive body for receiving an input signal containing a plurality of different wavelengths and transmitting the signal through it is described. An electro-optic block of material is secured to the body of the tuner and a reflective grating or mirror is secured to the electrooptic block of material for redirecting through the body the input signal as a plurality of signals, each containing a different one of the wavelengths. By appropriately varying a voltage placed across the electro-optic block of material, the index of refraction of the latter changes thereby altering the optical paths followed by the plurality of signals redirected through the body. In this manner, each of the signals containing a different one of the wavelengths can be selectively output from the body at different times and at the same, single location.
GRA

N87-11107# Department of the Air Force, Washington, D.C.
MINIATURE HIGH PERFORMANCE PULSED MODULATOR APPARATUS Patent
Walter E. Milberger and Franklin B. Jones, inventors (to Air Force) Issued 18 Mar. 1986 6 p Supersedes AD-D011427
(AD-D012266; US-Patent-4,577,166; US-Patent-Appl-SN-643201; US-Patent-Class-332-9T) Avail: US Patent and Trademark Office CSCL 09/5

A pulsed modulator apparatus having a ground deck clock driver unit to provide pulse stretching and on-off trigger signals for a floating deck transistor switch unit. Voltage isolation is achieved between the ground and floating deck units through the use of trigger transformers.
Author (GRA)

N87-11108# Burton Technologies, Inc., Raleigh, N.C.
CONTROL OF SURFACE ATTACK BY GALLIUM ALLOYS IN ELECTRICAL CONTACTS Final Report, 1 Aug. 1985 - 31 Mar. 1986
Ralph A. Burton and Ralph G. Burton 28 Mar. 1986 46 p
(Contract N00014-85-C-0893)
(AD-A168168; BTI-0003) Avail: NTIS HC A03/MF A01 CSCL 09/1

Electrical contact between a copper plated steel specimen and brushes of graphite and copper through a film of gallium alloy were investigated. Material compatibility phase changes were studied. Techniques of film renewal were tested as were results in inert atmosphere. Two testing machines were developed for both visual observation and long duration high current testing with computer monitoring and control.
GRA

N87-11109# Department of the Air Force, Washington, D.C.
RADIOFREQUENCY AMPLIFIER BASED ON A dc SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE Patent
Claude Hilbert, John M. Martinis, and John Clarke, inventors (to Air Force) Issued 29 Apr. 1986 8 p
(AD-D012353; US-Patent-4,585,999; US-Patent-Appl-SN-604547; US-Patent-Class-330-61R) Avail: US Patent and Trademark Office CSCL 09/5

A low noise radiofrequency amplifier, using a dc SQUID (superconducting quantum interference device) as the input amplifying element. The dc SQUID and an input coil are maintained at superconductivity temperatures in a superconducting shield, with the input coil inductively coupled to the superconducting ring of the dc SQUID. A radiofrequency signal from outside the shield is applied to the input coil and an amplified radiofrequency signal is developed across the dc SQUID ring and transmitted exteriorly of the shield. A power gain of 19.5 + or 0.5 dB has been achieved with a noise temperature of 1.0 + or 0.4 K at a frequency of 100 MHz.
Author (GRA)

N87-11110# Rome Air Development Center, Griffiss AFB, N.Y.
PRINTED CIRCUIT TRANSMISSION LINE TRANSITIONS
Frank E. Kozak and Daniel T. McGrath Dec. 1985 30 p
(AD-A169291; RADC-TR-85-241) Avail: NTIS HC A03/MF A01 CSCL 09/1

Three types of printed circuit transmission lines were investigated experimentally: microstrip; stripline; and grounded coplanar waveguide. Formulas for characteristic impedance were verified by measurements of lines on low-dielectric-constant substrates. Several designs of transitions from coaxial cable to microstripline were tested. The best of these was a uniform microstripline with

a flare at the connector end. A transition from coax into coplanar waveguide, and one from stripline into microstrip, had high reflection coefficients. Transitions from coax to stripline, and from coplanar waveguide to microstrip, had low reflection coefficients. GRA

N87-11111# Rome Air Development Center, Griffiss AFB, N.Y.
MICROSTRIP AMPLITUDE-WEIGHTED WILKINSON POWER DIVIDERS
Keith D. Huck Mar. 1986 29 p
(AD-A169450; RADC-TR-85-275) Avail: NTIS HC A03/MF A01 CSCL 05/5

Unequal-split reactive power dividers were examined for use in forming amplitude tapers for microstrip array antennas. Circuits with power ratios of up to 5.0 between arms were constructed on Rexolite substrate, for operation at 4.0 GHz and 7.5 GHz. The 4.0 GHz circuits were very accurate in forming the correct amplitude ratio between outputs, and in maintaining phase balance between outputs. Of those circuits designed for 7.5 GHz, only those with split ratios less than 2.5 worked correctly. This report includes a review of the theory, measured results, and recommendations for improved power dividers. GRA

N87-11112# California Univ., Berkeley. Lawrence Berkeley Lab.
STABILITY OF A VITREOUS ELECTROLYTE FOR POSSIBLE USE IN HIGH-TEMPERATURE LITHIUM/SULFUR CELLS
M. L. Smith, J. Winnick, F. R. McLarnon, and E. J. Cairns Apr. 1986 13 p Presented at the International Workshop on High Temperature Molten Salt Batteries, Argonne, Ill., 16 Apr. 1986
(Contract DE-AC03-76SF-00098)
(DE86-011563; LBL-20497; CONF-8604116-3) Avail: NTIS HC A02/MF A01

A family of lithium-borate glasses has been identified by H. Tuller and coworkers at the Massachusetts Institute of Technology as candidate electrolytes for use in high-temperature Li/S cells. Based upon screening tests, a glass composition (mol%) of 26% Li2O-7% Li2Cl2-67% B2O3 was selected to exhibit an acceptable ionic conductivity of 3 x 10 to the -3 ohm/cm ohm^{-1}cm^{-1} at 400 C, Tg = 475 C, resistance to attack by S at 400 C, and minimal attack by Li at 350 C. A procedure was developed to form and seal glass tubes, and LiSn/glass/S cells were operated at various temperatures. It was possible to charge and discharge cells at current densities up to 70 mA/sq cm (for 1-3 min) or 20 mA/sq cm (for several hr) into the two-phase S-Li2S(sub x) region, but the electrolyte tended to fail when the cell was recharged from near the two-phase/single-phase boundary at approx. 73 mol% S. The charge-discharge curves also exhibited hysteresis effects, and a crystalline reaction layer was observed on the S side of the electrolyte tubes. X-ray diffraction analyses suggested that the reaction layer contained crystalline lithium-borate compounds, and static immersion tests showed that the glass was slowly attacked by polysulfides at the 400 C cell operating temperature. DOE

N87-11113# British Aerospace Public Ltd. Co., Bristol (England).
RADIATION HARDNESS ASSURANCE OF ELECTRONIC COMPONENTS, WITH SPECIAL REFERENCE TO SEMICONDUCTOR DEVICES AND EVALUATION STATISTICS
A. H. George Nov. 1982 21 p
(BAe-BT-13801; LR47675; ETN-86-97960) Avail: NTIS HC A02/MF A01

Statistical requirements of nuclear radiation testing of sensitive semiconductor devices are considered and a procedure to enable an appropriate reliability assessment to be made in the event of a nuclear weapon explosion is outlined. The procedure is demonstrated using reported radiation test data for commercial memory devices. The resulting statistically assessed hardness is used to find the reliability impact at a 95% confidence level on a hypothetical equipment with a specified level of radiation environment and a population of 10 such devices. ESA

N87-11114# British Aerospace Public Ltd. Co., Bristol (England). Laser Systems Dept.
VARACTOR TUNED X-BAND FET OSCILLATOR M.S. Thesis
M. A. Higgins May 1983 257 p
(BAe-BT-14500; LR48626; ETN-86-97964) Avail: NTIS HC A12/MF A01

A variable frequency X-band oscillator was designed. The oscillator is based on field effect transistors and is voltage tuned with a varactor. The oscillator may be a unit on its own or integrated into a larger subsystem, which reduces the overall size and weight. Several designs were implemented using thin film technology and evaluated using two transistor types of the same generic family. The results were fed back into the design to improve overall performance and understanding of the process of implementation. The result is a 1GHz bandwidth tunable oscillator with a center frequency variable with bias. There is a substantial sensitivity of output frequency with bias and hence additional measurements were made. The effect of changing bias on performance is calculated. ESA

N87-11115# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ACTIVE MICROWAVE INSTRUMENTATION TRAVELING WAVE TUBE (TWT) AMPLIFIERS: ELECTRICAL MODES, PHASE 2 Final Report
W. Mueller, G. Riebold, K. Rogalla, A. Schwarz, Ph. Sopper, W. Borst, and P. Malzahn Paris ESA 15 Nov. 1985 203 p
(Contract ESA-5076/82-NL-PP)
(AMI/2/18; ESA-CR(P)-2228; ETN-86-98109) Avail: NTIS HC A10/MF A01

A Traveling Wave Tube Amplifier (TWT-A) and a klystron amplifier were developed for the Active Microwave Instrument of the ESA satellite ERS-1. Performance tests are summarized. Results show the feasibility of building a high power amplifier to operate under ERS-1 conditions and support the selection of either a TWT or a klystron for use on the ERS-1 spacecraft. ESA

N87-11116# Technische Hogeschool, Delft (Netherlands). Dept. of Electrical Engineering.
DESIGN, DEFINITION, AND MANUFACTURE PARTICIPATION FOR THE SAR ELECTRONIC POWER CONVERTER (EPC) BREADBOARD
J. B. Klaassens and F. C. Schwarz Paris ESA May 1983 30 p Prepared for Technische Physische Dienst TNO-TH, Delft, Netherlands
(Contract ESA-4657)
(ESA-CR(P)-2249; ETN-86-98126) Avail: NTIS HC A03/MF A01

A principle of fine regulation applied to the high voltage line supplying a pulsed load (radar tube) is presented. The high voltage power supply system is a combination of a single series resonant converter and a capacitor multiplier in the output stages. The electronic power conversion system uses a Schwarz converter employing a series resonant circuit for the transfer and control of power. An internal frequency of 35 kHz enhances the power density of the converter model. This model provides 16 kV for the helix-cathode circuit of a klystron with an accuracy of 0.5 per mill and 11 kV for the collector-cathode circuit with an accuracy of 5%. Experiments suggest that the improved power supply should alleviate problems associated with high voltage transformers and ensure the high accuracy required for the voltage control for the helix-cathode circuit to avoid distortion in the returning signal of a spaceborne radar system. ESA

N87-11117# Toulouse Univ. (France). Lab. de Chimie-Physique et Electrochimie.
ELECTROMECHANICAL STUDY CONTRIBUTING TO THE FORMULATION OF AN ANALOG EVOLUTIONARY MODEL REPRESENTING NICKEL-CADMIUM BATTERIES [ETUDE ELECTROCHIMIQUE EN VUE DE L'ELABORATION D'UN MODELE EVOLUTIF ANALOGIQUE POUR LA REPRESENTATION DE BATTERIES NICKEL-CADMIUM]
P. Delorme, J. M. Harismendy, and M. Comtat Paris ESA 16 Mar. 1984 78 p In FRENCH
(Contract ESA-4999/82-F-DD(SC))
(Rept-JMH/GB/GR/769-84; ESA-CR(P)-2252; ETN-86-98129) Avail: NTIS HC A05/MF A01

Nickel cadmium battery open circuit impedance measurements between 0.001 and 1000 Hz, kinetic studies of the dissolution of the separator in KOH solution, and the time evolution of the electrode capacities when subjected to charge-discharge cycles either at constant current or constant voltage are described. The equivalent electrical model shows an assymetry in the representation of the two electrodes. The battery is represented by a circuit implemented by 11 components. It is shown that no single circuit can represent the battery at any load regime. ESA

N87-11118# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
MICROWAVES AND MICROELECTRONICS
Staffan Rudner, Aake Bergquist, and Sven Hagelin May 1986 59 p In SWEDISH; ENGLISH summary
(FOA-C-30426-E; ISSN-0347-3708; ETN-86-98334) Avail: NTIS HC A04/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR 50

The status of microwave components and circuits is presented, especially microwave integrated circuits. The trend to more miniaturization is increasing. Manufacturing processes allow active components of critical dimensions in the submicrometer area to be produced. Prototypes of several circuits and function aggregates are reviewed. ESA

N87-11027*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
A PROTOTYPE DSN X/S-BAND FEED: MODEL 3 DEVELOPMENT
D. A. Bathker and H. F. Reilly *In its* The Telecommunications and Data Acquisition Report (date) p 26 - 32 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

N87-11032*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A RECURSIVE SOLUTION FOR A FADING MEMORY FILTER DERIVED FROM KALMAN FILTER THEORY
J. I. Statman *In its* The Telecommunications and Data Acquisition Report (date) p 70 - 76 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11033*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
AN ESTIMATOR-PREDICTOR APPROACH TO PLL LOOP FILTER DESIGN
J. I. Statman and W. J. Hurd *In its* The Telecommunications and Data Acquisition Report (date) p 77 - 89 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11035*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
PHASE LOCK ACQUISITION FOR SAMPLED DATA PLLS USING THE SWEEP TECHNIQUE
S. Aguirre, D. H. Brown, and W. J. Hurd *In its* The Telecommunications and Data Acquisition Report (date) p 95 - 102 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11040*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A VLSI ARCHITECTURE FOR PERFORMING FINITE FIELD ARITHMETIC WITH REDUCED TABLE LOOK-UP
I. S. Hsu, T. K. Truong, and I. S. Reed *In its* The Telecommunications and Data Acquisition Report (date) p 143 - 154 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11041*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A NEW VLSI COMPLEX INTEGER MULTIPLIER WHICH USES A QUADRATIC-POLYNOMIAL RESIDUE SYSTEM WITH FERMAT NUMBERS
T. K. Truong, I. S. Hsu, J. J. Chang, H. C. Shyu, and I. S. Reed *In its* The Telecommunications and Data Acquisition Report (date) p 155 - 163 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11043*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
A SYSTEM FOR THE FUNCTIONAL TESTING AND SIMULATION OF CUSTOM AND SEMICUSTOM VLSI CHIPS
E. M. Olson and L. J. Deutsch *In its* The Telecommunications and Data Acquisition Report (date) p 171 - 180 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09A

N87-11044*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
PROTOTYPING AND IMPLEMENTING FLIGHT QUALIFIABLE SEMICUSTOM CMOS P-WELL BULK INTEGRATED CIRCUITS IN THE JPL ENVIRONMENT
E. M. Olson *In its* The Telecommunications and Data Acquisition Report (date) p 181 - 192 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09A

N87-11046*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Telecommunications Systems Section.
IMPROVED PERFORMANCE OF A DIGITAL PHASE-LOCKED LOOP COMBINED WITH A FREQUENCY/FREQUENCY-RATE ESTIMATOR
A. Mileant and M. Simon *In its* The Telecommunications and Data Acquisition Report (date) p 203 - 215 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11047*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
VLA FEEDHORN FOR VOYAGER ENCOUNTER OF NEPTUNE
F. Manshadi, D. A. Bathker, and H. W. Marlin *In its* The Telecommunications and Data Acquisition Report (date) p 216 - 226 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11048*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
X-BAND PREAMPLIFIER FILTER
F. Manshadi *In its* The Telecommunications and Data Acquisition Report (date) p 227 - 230 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09C

N87-11050*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
FINITE WORDLENGTH IMPLEMENTATION OF A MEGACHANNEL DIGITAL SPECTRUM ANALYZER
E. H. Satorius, M. J. Grimm, G. A. Zimmerman, and H. C. Wilck *In its* The Telecommunications and Data Acquisition Report (date) p 244 - 254 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N87-11119# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

COMPUTATIONAL FLUID DYNAMICS, VOLUME 2
1986 367 p Lecture Series held in Rhode Saint Genese, Belgium, 3-7 Mar. 1986
(VKI-LS-1986-04-Vol-2; ETN-86-97813) Avail: NTIS HC A16/MF A01

Direct numerical simulation of homogeneous strained turbulence; finite element methods for incompressible Navier-Stokes and for shallow water equations; and finite element methods for compressible viscous flows using self adaptive mesh refinements were discussed. For individual titles, see N87-11120 through N87-11122.

N87-11120# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIRECT NUMERICAL SIMULATION OF HOMOGENEOUS STRAINED TURBULENCE
Dang Khoa *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dynamics, Volume 2 1986 96 p (For primary document see N87-11119 02-34)
Avail: NTIS HC A16/MF A01

Direct numerical simulation of strained homogeneous turbulent flows of incompressible and compressible fluids is introduced. The equations to be solved and features of the rate of strain tensors required by the homogeneity hypothesis are discussed. The motivations of such simulations and their relationship with the modeling of turbulence in real flows are outlined. Numerical techniques used to solve the unsteady Navier-Stokes equations in the case of periodic boundary conditions are outlined with examples of data processing. The large eddy simulation technique used to overcome the low Reynolds number limitation due to insufficient spatial discretization is mentioned. ESA

N87-11121# Electricite de France, Chatou.
FINITE ELEMENT METHODS FOR INCOMPRESSIBLE NAVIER-STOKES AND FOR SHALLOW WATER EQUATIONS
A. Hauguel and J. Cahouet *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dynamics, Volume 2 1986 160 p (For primary document see N87-11119 02-34)
Avail: NTIS HC A16/MF A01

Finite element methods to solve turbulent Navier-Stokes and shallow water equations are outlined. The advection-diffusion equation is introduced. The Stokes problem for incompressible and compressible flow is analyzed. Studies using finite element codes in industrial problems with incompressible Navier-Stokes equations, and in environmental studies with shallow water equations are summarized. ESA

N87-11122# Institut National de Recherche d'Informatique et d'Automatique, Le Chesnay (France).
FINITE ELEMENT METHODS FOR THE CALCULATION OF COMPRESSIBLE VISCOUS FLOWS USING SELF-ADAPTIVE MESH REFINEMENTS
M. O. Bristeau and J. Periaux (Avions Marcel Dassault, Saint-Cloud, France) *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dynamics, Volume 2 1986 108 p (For primary document see N87-11119 02-34)
(Contracts DRET-83-403; DRET-84-014)
Avail: NTIS HC A16/MF A01

Finite element methods for solving compressible viscous flow problems modeled by the unsteady Navier-Stokes equations, written in conservative form or not, are presented. The main numerical ingredients are based on semi or fully implicit centered schemes for time integration, robust least squares and associated preconditioned conjugate gradient algorithms, and self adaptive mesh refinement techniques for accuracy improvement. They were used to simulate two and three dimensional transonic and supersonic flows around geometries of industrial interest. Numerical experiments are in good agreement with measurements. ESA

N87-11123*# Texas Univ., Austin. Dept. of Mechanical Engineering.
THE EFFECT OF A ROW OF HELMHOLTZ RESONATORS ON THE TURBULENCE IN A BOUNDARY LAYER Semiannual Progress Report
Ronald L. Panton 30 Sep. 1986 6 p
(Grant NAG1-610)
(NASA-CR-179832; NAS 1.26:179832) Avail: NTIS HC A02/MF A01 CSCL 20D

Detailed acoustic measurements were made of the resonator's response as the free stream speed was varied from 30 mph to 155 mph. The average sound pressure level (SPL) and peak frequency response clearly show the existence of strong tuning between the boundary layer and the resonator for the Helmholtz (f sub 0) mode as well as for the first standing wave (f sub 1) mode. The narrow speed range for tuning and the gap between the strong tuning for the Helmholtz mode and the first standing wave mode is evident. The frequency at which the peak SPL response occurred at each speed is given. The peak response for the Helmholtz mode occurred at a free stream velocity of 26 m/s (at which RE sub theta = 6,560) with a resonant frequency of 570 Hz and a sound pressure level of 141 dB. The peak response for the first standing wave occurs at the maximum wind tunnel speed of 70 m/s (at which Re sub theta = 14,900) Hz with a resonant frequency of 1,890 Hz and a sound pressure level of 154 dB. At resonance the microphones do not maintain a constant SPL, but rather the latter fluctuates in a seemingly random fashion. The values presented here are time averaged rms values. Of interest was the occurrence of phase locking between adjacent resonators witha phase lag of 180 deg. This report covers the period from 5 May to 30 September on the subject project. Author

N87-11124*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOHYDRODYNAMIC ANALYSIS FOR LAMINAR LUBRICATING FILMS
Harold G. Elrod and David E. Brewe 1986 14 p Presented at the Leeds-Lyon Symposium on Tribology, Leeds, England, 8-12 Sep. 1986
(NASA-TM-88845; E-3235; NAS 1.15:88845;
USAAVSCOM-TR-86-C-33) Avail: NTIS HC A02/MF A01 CSCL 20M

A Galerkin-type analysis to include thermal effects in laminar lubricating films was performed. The lubricant properties were assumed constant except for a temperature-dependent Newtonian viscosity. The cross-film temperature profile is established by collocation at the film boundaries and two interior Lobatto points. The interior temperatures are determined by requiring that the zeroth and first moment of the energy equation be satisfied across the film. The fluidity is forced to conform to a third--degree polynomial appropriate to the Lobatto-point temperatures. Preliminary indications are that the use of just two such sampling points enables satisfactory prediction of bearing performance even in the presence of substantial viscosity variation. Author

N87-11125*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE LENGTH EFFECTS IN TAYLOR-COUETTE FLOW
C. L. Streett and M. Y. Hussaini Sep. 1986 31 p
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178175; ICASE-86-59; NAS 1.26:178175) Avail: NTIS HC A03/MF A01 CSCL 20D

Axisymmetric numerical solutions of the unsteady Navier-Stokes equations for flow between concentric rotating cyclinders of finite length are obtained by a spectral collocation method. These representative results pertain to two-cell/one-cell exchange process, and are compared with recent experiments. Author

N87-11126*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
CONDUCTION INVESTIGATIONS INTO THE MAGNETIC PROPERTIES OF MATTER Final Report, period ending 1 Aug. 1986
H. Chagini and Robert L. Ash Jul. 1986 12 p

(Contract NAS1-17993)
(NASA-CR-179868; NAS 1.26:179868) Avail: NTIS HC A02/MF A01 CSCL 20D

The thermal analysis of a heat exchanger for heating air to temperatures on the order of 3000 C for use in NASA's high temperature wind tunnel is presented. It was ascertained that an externally finned shell-and-tube type of heat exchanger with counterflow could be considered for this application. The methods of estimating the convective heat transfer coefficients are outlined in this report. As a part of thermal design the required size of heat exchanger was predicted. As a result of the extreme length required (approx. = 1/2 km), it was determined that a conventional heat exchanger may not be the most suitable tool for this application. Author

N87-11127*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME RECENT DEVELOPMENTS IN SPECTRAL METHODS Final Report
M. Y. Hussaini Aug. 1986 20 p Presented at the 10th International Conference on Numerical Methods in Fluid Dynamics Submitted for publication
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178178; NAS 1.26:178178; ICASE-86-57) Avail: NTIS HC A02/MF A01 CSCL 20D

This paper is solely devoted to spectral iterative methods including spectral multigrid methods. These techniques are explained with reference to simple model problems. Some Navier-Stokes algorithms based on these techniques are mentioned. Results on transition simulation using these algorithms are presented. Author

N87-11128# Air Force Armament Lab., Eglin AFB, Fla.
THREE-DIMENSIONAL UNSTEADY EULER EQUATIONS SOLUTIONS ON DYNAMIC GRIDS Final Technical Report, Jan. - Jun. 1985
Dave M. Belk, J. M. Janus, and D. L. Whitfield Apr. 1986 30 p
(AD-A168041; AD-E801301; AFATL-TR-86-21) Avail: NTIS HC A03/MF A01 CSCL 20/4

A method is presented for solving the three-dimensional unsteady Euler equations on dynamic grids based on flux vector splitting. The equations are cast in curvilinear coordinates and a finite volume discretization is used for handling arbitrary geometries. The discretized equations are solved using an explicit upwind second-order predictor corrector scheme that is stable for a CFL of 2. Characteristic variable boundary conditions are developed and used for unsteady impermeable surfaces and for the far-field boundary. Dynamic-grid results are presented for an oscillating airfoil and for a store separating from a reflection plate. For the cases considered of stores separating from a reflection plate, the unsteady aerodynamic forces on the store are significantly different from forces obtained by steady-state aerodynamics with the body inclination angle changed to account for plunge velocity. GRA

N87-11129# Air Force Academy, Colo. Research Lab.
VISUALIZATION OF THREE-DIMENSIONAL FORCED UNSTEADY SEPARATED FLOW
M. Robinson, H. Helin, F. Gilliam, J. Russell, and J. Walker 1986 11 p
(AD-A168939; FJSRL-TJ-86-0007) Avail: NTIS HC A02/MF A01 CSCL 20/4

Three-dimensional unsteady flow separation was visualized for a semi-infinite span wing pitched upward at a constant rate from 0 to 60 deg angles of attack. Initially, many of the same complex flow perturbations, including the formation of leading and trailing edge vortices observed from two-dimensional flow separation were evident. Using the semi-infinite wing, the flow field was further complicated by a wing tip vortex that developed orthogonal to the separation induced leading and trailing edge vortices. The tip flow distorted the development of the initially two-dimensional inboard, leading edge vortex. The simple pitching motion history permitted resolution of the development of individual vortices as a function of airfoil motion parameters. Also, vortex-vortex interactions were examined between separation-induced vortices and wingtip vortices. The interactions were characterized for time periods that extended well beyond the actual pitching motions. Author (GRA)

N87-11130# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
THE SOLUTION OF THE PARABOLIZED NAVIER-STOKES EQUATIONS
D. Brian Spalding Feb. 1986 19 p Lecture held in Rocquencourt, France, 14 Apr. 1986
(CFD/86/2; ETN-86-97977) Avail: NTIS HC A02/MF A01

Solution of the parabolized Navier-Stokes equation using the stream-function/vorticity method; the velocity/vorticity-gradient method; pressure-uncoupling with the SIVA method; and pressure-uncoupling with the SIMPLE method is summarized. Full-Navier-Stokes solution by SIVA and SIMPLE; the partially-parabolic formulation; and the PHOENICS formulation are described. ESA

N87-11131# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1985-5, 228/SEPTEMBER-OCTOBER
Claude Sevestre, ed. ESA May 1986 64 p Transl. into ENGLISH of "La Recherche Aerospatiale, Bulletin Bimestriel, no. 1985-5" Paris, France, ONERA, Sep. Oct. 1985
(ESA-TT-964; ETN-86-97803) Avail: NTIS HC A04/MF A01; HC in English and original report in French available ONERA, Paris, France FF 70

Time-frequency representation of broad band signals; Ni's multigrid method; combustion of a nonmoving droplet (numerical study of the influence of the assumptions leading to the D sq law); rapid convergence numerical methods for calculating reactive flows; and experience in parallelizing numerical algorithms for MIMD architectures, using asynchronous methods are discussed. ESA

N87-11132# British Aerospace Public Ltd. Co., Bristol (England). Mechanical Technology Dept.
ELECTRO-RHEOLOGICAL FLUIDS. A BRIEF DESCRIPTION AND TYPICAL APPLICATIONS
S. D. Rossides Oct. 1982 14 p
(BAe-BT-13744; LR47282; ETN-86-97959) Avail: NTIS HC A02/MF A01

Fiber formation; electrorheological (ER) fluids composition; electrical properties of ER fluids; modes of operation of ER fluids; valve pressure drop calculation; valve type devices; ER clutch; and damping devices are reviewed. ESA

N87-11133# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Reaktorsicherheit.
THE DYNAMICS OF HEAT TRANSFER IN TURBULENT PIPE FLOW, PART 3
Heinz Schmidl Mar. 1986 67 p In GERMAN; ENGLISH summary
(OEFZS-4351; RS-271/86; ETN-86-97881) Avail: NTIS HC A04/MF A01

The energy equation of a turbulent pipe flow was solved. The temperature distribution in the turbulent pipe flow was described by a system of differential equations. The different parameters of the equations were varied. The correlation between the P-functions and the K-factors is explained. A partial solution composed of two series which leads to a hypergeometric differential equation, and the computer program used for the solution are discussed. A general solution consisting of several series was determined; its numerical evaluation is explained. ESA

N87-11134# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
A THEORY OF FRACTAL FLUIDS
E. G. Schlechtendahl May 1986 63 p
(KfK-4070; ISSN-0303-4003; ETN-86-98190) Avail: NTIS HC A04/MF A01

A fluid mechanics method for problems where local flow characteristics are different from averages in a control volume is

presented. The method is based on a rigorous treatment of the transport theorem and uses Taylor series expansions of the essential functions whenever exact solutions cannot be obtained. A closed system of partial differential equations is derived. It contains conventional fluid dynamics as a special case, and results which can be derived from the kinetic theory of gases. The equations include balance equations for the conventional quantities mass and momentum, as well as quantities not treated by the conventional theories, such as the first spatial moment of the density distribution (its divergence gives a quantitative measure of the density pattern, bubble flow versus droplet flow), the first spatial moment of the velocity distribution, and the velocity correlation (a symmetrical tensor representing the deviation of the local velocity from its mass weighted average). ESA

N87-11135# Kernforschungszentrum, Karlsruhe (West Germany).
ON THE NUMERICAL INTEGRATION OF VISCOPLASTIC MODELS
V. K. Arya, K. Hornberger, and H. Stamm May 1986 49 p
(KfK-4082; ISSN-0303-4003; ETN-86-98192) Avail: NTIS HC A03/MF A01

Explicit integration methods are examined as to their effectiveness in the integration of nonlinear and stiff constitutive equations of viscoplastic models. The use of a simple Euler-forward method with an automatic time step control strategy is seen to be encouraging. The capabilities of several such time step control strategies are assessed. The success of integration strategies depends on the particular viscoplastic model being integrated. ESA

N87-11136# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
NUMERICAL SIMULATION OF THE FORMATION OF TWO AND THREE-DIMENSIONAL STRUCTURES IN SHEAR LAYERS AND WAKES Ph.D. Thesis - Karlsruhe Univ., West Germany
Eckart Meiburg Dec. 1985 135 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-10; ISSN-0171-1342; ETN-86-98180) Avail: NTIS HC A07/MF A01; DFVLR, Cologne, West Germany DM 41

The nonlinear formation of two and three-dimensional structures in nominally two-dimensional shear layers and wakes was numerically investigated, assuming spatially periodic flow. The vorticity dynamics was simulated using the Biot-Savart law. The instability of the braid region, the translative instability of the vortex cores, and the helical pairing mechanism were analyzed for the simple shear layer. The wake flow was investigated with regard to possible changes in the topological structure of the vorticity field. Comparisons with experimental observations indicate the importance of subharmonic perturbations in the wake; their origin is, however, unclear. Further investigations are necessary to determine the effects of friction. ESA

N87-11137# Kaiserslautern Univ. (West Germany). Dept. of Mathematics.
ON KNUDSEN FLOWS WITHIN THIN TUBES
Hans Babovsky 1986 27 p
(Preprint-97; ETN-86-98273) Avail: NTIS HC A03/MF A01

The time evolution of a rarefied gas in a long thin tube is studied. The Clausing (1930) hypothesis is tested: Assuming collisions between gas particles can be neglected, the dynamics of the gas is well approximated by a diffusion process. It is proved that the evolution tends to that of a diffusion process as the radius of the tube decreases to zero. ESA

N87-11138# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
SOME CALCULATIONS BASED ON A MATHEMATICAL MODEL FOR FLUID FLOW THROUGH A COLLAPSIBLE TUBE
J. A. vanGelderen 1985 26 p
(Rept-85-41; ETN-86-98471) Avail: NTIS HC A03/MF A01

The generation and stability of self excited oscillations in fluid flowing through an elastic tube subject to transmural pressure were studied using a mathematical model. The tube is modeled partly as an elastic membrane under longitudinal tension and partly having collapse resistance. Poisson's ratio for the elastic material is assumed to be zero. The fluid in the tube is incompressible and inviscid and in unsteady motion. All fluid variables are supposed to be uniform in any cross section normal to the axis of the tube. The coordinate system is attached to the wall of the tube. Solutions for fluid pressure, fluid velocity, distance along the axis, and longitudinal tension are presented. A boundary value problem is solved. ESA

N87-11139# Technische Hogeschool, Delft (Netherlands). Werktuigbouwkunde.
THE SCALING OF TWO PHASE FLOW Thesis [HET SCHALEN VAN TWEE-FASEN STROMING]
A. Dijkshoorn Mar. 1986 108 p
(MEAH-64; Wb/AHD-211; ETN-86-98487) Avail: NTIS HC A06/MF A01

Similarity criteria applicable to gas-liquid flows (scaling laws) were investigated. The scaling laws were derived from the conventional equations governing gas-liquid flows; gravitational acceleration was found to be a limiting parameter for proper scaling. Experiments conducted to verify a scaling down factor of 10 when using artificially increased gravity are described. The pressure drop, void fraction, and flow pattern of the horizontal two-phase flow in a 50 mm diameter pipe and in a rotating 5 mm pipe were compared. Comparison shows that the dimensionless pressure drops are equal within 20%, while the void fractions are equal within the accuracy of the measurements (3%). The flow patterns mainly consist of stratified and intermittent flow. It is concluded that it is possible to scale two-phase flow when using dimensionless numbers. ESA

N87-11140# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
MULTIGRID APPROACHES TO THE EULER EQUATIONS
P. W. Hemker and G. M. Johnson Jan. 1986 16 p Submitted for publication Sponsored by Netherlands Technical Foundation
(CWI-NM-R8602; B8667669; ETN-86-98506) Avail: NTIS HC A02/MF A01

Approaches to the Euler equations for compressible flow are discussed. The multigrid acceleration of the solution process for finding approximations to the steady state solution is emphasized. Methods based on Lax-Wendroff type time-stepping, methods based on semidiscretization and time-stepping, and fully implicit methods based on semidiscretization are covered. The two dimensional case is treated to keep notation simple. ESA

N87-11141# Fleming (W. S.) and Associates, Inc., Syracuse, N.Y.
RESIDENTIAL EARTH-COUPLED HEAT PUMP DEMONSTRATION
P. J. Hughes Oct. 1985 294 p Sponsored in part by New York State Energy Research and Development Authority, Niagara Mohawk Power Corp. and Rochester Gas and Electric Corp.
(PB86-212396; NYSERDA-85-20) Avail: NTIS HC A13/MF A01 CSCL 13A

The report, Residential Earth-coupled Heat Pump Demonstration, describes a field-test program for evaluating nine residential Earth-coupled heat pump systems, located in upstate New York homes. Horizontal and vertical Earth coils were used in conjunction with heat pumps of several different manufacturers to provide heating, air conditioning and domestic hot water at each of the sites. Results of the project found that Earth-coupled heat pumps could significantly reduce the energy required for the heating and cooling functions, while providing a lower and more uniform electric demand. Also, the project report summarized the detailed performance and consumer economics of these systems. GRA

N87-11184*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST TURBINE HEAT TRANSFER OVERVIEW
John E. Rohde *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11201*# United Technologies Research Center, East Hartford, Conn.
MASS AND MOMENTUM TURBULENT TRANSPORT EXPERIMENTS
B. V. Johnson and R. Roback *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
(Contract NAS3-22771)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11202*# Garrett Corp., Phoenix, Ariz.
NASA DILUTION JET MIXING, PHASE 3
R. Srinivasan, G. Myers, and C. White *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11206*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
THE 3D INELASTIC ANALYSIS METHODS FOR HOT SECTION COMPONENTS
M. L. Roberts, R. L. McKnight, L. T. Dame, and P. C. Chen *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 3 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11219*# General Motors Corp., Detroit, Mich. Gas Turbine Div.
TURBINE AIRFOIL GAS SIDE HEAT TRANSFER
Edward R. Turner *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 14 p (For primary document see N87-11180 02-39)
(Contract NAS3-23695)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11220*# Scientific Research Associates, Inc., Glastonbury, Conn.
CALCULATION OF TWO- AND THREE-DIMENSIONAL TRANSONIC CASCADE FLOW FIELD USING THE NAVIER-STOKES EQUATIONS
B. C. Weinberg, R.-J. Yang, S. J. Shamroth, and H. McDonald *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
(Contract NAS3-23695)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11221*# United Technologies Research Center, East Hartford, Conn.
MEASUREMENT OF AIRFOIL HEAT TRANSFER COEFFICIENTS ON A TURBINE STAGE
Robert P. Dring and Michael F. Blair *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11222*# Stanford Univ., Calif. Thermosciences Div.
EFFECTS OF VERY HIGH TURBULENCE ON CONVECTIVE HEAT TRANSFER
Robert J. Moffat and Paul K. Maciejewski *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11223*# Tennessee Univ. Space Inst., Tullahoma.
GAS FLOW ENVIRONMENTAL AND HEAT TRANSFER NON-ROTATING 3D PROGRAM
R. A. Crawford *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 5 p (For primary document see N87-11180 02-39)
(Contract NAS3-23278)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11224*# United Technologies Research Center, East Hartford, Conn.
ASSESSMENT OF A 3-D BOUNDARY LAYER CODE TO PREDICT HEAT TRANSFER AND FLOW LOSSES IN A TURBINE
Olof L. Anderson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
(Contract NAS3-23716)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11225*# Pratt and Whitney Aircraft, East Hartford, Conn.
COOLANT PASSAGE HEAT TRANSFER WITH ROTATION, A PROGRESS REPORT
F. C. Kopper *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

N87-11415 Marburg Univ. (West Germany). Fachbereich Physik.
TURBULENCE THEORY FROM A PRESENT-DAY POINT OF VIEW [THEORIE DER TURBULENZ AUS HEUTIGER SICHT]
Siegfried Grossmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 115-118 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N87-11142*# Morgan State Univ., Baltimore, Md.
THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROSCOPIC FILMS. 1: FILM BATCH VARIATIONS OF RECIPROCITY FAILURE IN IIaO FILM. 2: THERMAL AND AGING EFFECTS IN RELATIONSHIP TO RECIPROCITY FAILURE. 3: SHIFTING OF RECIPROCITY FAILURE POINTS AS A FUNCTION OF THERMAL AND AGING EFFECTS Semiannual Report, Dec. 1986
Kevin A. Peters, Pamela F. Atkinson, and Ernest C. Hammond, Jr. 1986 51 p Sponsored by NASA
(NASA-CR-179833; NAS 1.26:179833) Avail: NTIS HC A04/MF A01 CSCL 14E

Reciprocity failure was examined for IIaO spectroscopic film. Three separate experiments were performed in order to study film batch variations, thermal and aging effects in relationship to reciprocity failure, and shifting of reciprocity failure points as a function of thermal and aging effects. The failure was examined over ranges of time between 5 and 60 seconds. The variation to illuminance was obtained by using thirty neutral density filters. A standard sensitometer device imprinted the wedge pattern on the film as exposure time was subjected to variation. The results indicate that film batch differences, temperature, and aging play an important role in reciprocity failure of IIaO spectroscopic film. A shifting of the failure points was also observed in various batches of film. Author

N87-11143*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USING A 3-DIMENSIONAL LASER ANEMOMETER TO DETERMINE MEAN STREAMLINE PATTERNS IN A TURBULENT FLOW

K. L. Orloff and P. K. Snyder Jul. 1984 16 p
(NASA-TM-85948; A-9723; NAS 1.15:85948) Avail: NTIS HC A02/MF A01 CSCL 14B

The determination of mean streamline patterns by moving the test point in the direction of the measured velocity is shown to produce cumulative errors that are unacceptable. A two-dimensional algorithm that minimizes these errors is presented and is analytically validated using simple potential flows. The algorithm is extended to three-dimensional flows and is again validated analytically. Finally, as an example of a typical application of the algorithm, mean streamlines are measured in a complex, turbulent flow with a three-dimensional laser anemometer. Author

N87-11144*# United Technologies Corp., East Hartford, Conn.
HOT SECTION VIEWING SYSTEM
William W. Morey Sep. 1984 141 p
(Contract NAS3-23156)
(NASA-CR-174773; NAS 1.26:174773; R84-925830-33) Avail: NTIS HC A07/MF A01 CSCL 14B

This report covers the development and testing of a prototype combustor viewing system. The system allows one to see and record images from the inside of an operating gas turbine combustor. The program proceeded through planned phases of conceptual design, preliminary testing to resolve problem areas, prototype design and fabrication, and rig testing. Successful tests were completed with the viewing system in the laboratory, in a high pressure combustor rig, and on a Pratt and Whitney PW20307 jet engine. Both film and video recordings were made during the tests. Digital image analysis techniques were used to enhance images and bring out special effects. The use of pulsed laser illumination was also demonstrated as a means for observing liner surfaces in the presence of luminous flame. Author

N87-11145# Department of the Air Force, Washington, D.C.
RADIATION UPSET THRESHOLD DETECTOR APPARATUS Patent
Edmund J. Vitek, Robert O. Cherney, and Robert F. Snyder, Jr., inventors (to Air Force) Issued 7 Jan. 1986 4 p Supersedes AD-D011030
(AD-D012260; US-Patent-4,563,641; US-Patent-Appl-SN-550286; US-Patent-Class-324-158) Avail: US Patent and Trademark Office CSCL 18/4

This patent discloses a radiation upset threshold detector apparatus for measuring the output from a circuit that is operating in a radiation environment to determine when the radiation upset threshold is exceeded for the circuit. GRA

N87-11146# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A FAST RESPONSE THERMAL CONDUCTIVITY GAGE Final Report
James O. Pilcher, II and Melinda B. Krummerich Apr. 1986 38 p
(AD-A168185; BRL-TR-2726) Avail: NTIS HC A03/MF A01 CSCL 14/2

During the spring of 1983, the Ballistic Research Laboratory measured behind-the-armor effects for several weapons against a variety of targets. One of the major concerns was heat generation during and immediately following impact of the warhead against the targets. Previous tests of this type had used thin skin total heat gages and standard laboratory heat detectors. Thin skin gages record only the maximum temperature attained by the skins' back surface with no indication of the time required to reach this temperature. Although an approximation of the total heat deposition can be made, no rate of deposition can be estimated without knowing the time of the event. The large thermal mass of a typical laboratory detector such as an infrared power meter is designed to measure a steady-state flux and cannot respond quickly enough to register a transient event. Neither gage type can withstand severe blast and shock environments. Since the temperature inside the target rose sharply in a very short time, special thermal fluence gages were fabricated which emphasized the time response of the gage rather than its thermal capacity. This gage is used when the thermal flux is of short duration, 150 milliseconds or less, and of low total energy, 179 calories per square centimeter or less. The maximum operating temperature of the gage is 500 degree Celsius. GRA

N87-11147# Oak Ridge National Lab., Tenn.
ANALYSIS OF LOOP CURRENT STEP RESPONSE DATA OBTAINED FROM IN SITU TESTS OF TEMPERATURE DETECTORS
L. F. Miller and R. L. Shepard May 1986 40 p
(Contract DE-AC05-84OR-21400)
(DE86-011750; ORNL/TM-10087) Avail: NTIS HC A03/MF A01

Methods for obtaining unbiased parameter estimates from data obtained by in situ tests of temperature detectors are evaluated. A computer program that calculates unbiased estimates of parameters that define a dynamic model of the temperature detector and that calculates standard deviations of the model parameters and of the response time is presented. The computer program, along with the associated theoretical development, represent an extension of the previous capability for analyzing data from in situ tests of temperature detectors. DOE

N87-11148# Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Unternehmensgruppe Nachrichtentechnik.
DEVELOPMENT AND TEST OF A MINIATURIZED FIBER-OPTIC GYROSCOPE Final Report, Jun. 1985
Wilfried Auch, Friedmann Mohr, and Otto Strobel Bonn, West Germany BMFT Dec. 1985 167 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-85-033; ISSN-0170-1339; ETN-86-97846) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 33

A fiber-optic rotation rate sensor, based on the Sagnac effect, as a replacement for mechanical gyros in inertial navigation systems was developed. Four different laboratory models of a fiber gyro were developed. With a miniaturized version a sensitivity in the 1 deg/hr range is achieved. Optical components technology was investigated to provide the basis for the size reduction. It is demonstrated that the fiber gyro has the potential to become a rugged, maintenance-free, all-solid state strapdown sensor. ESA

N87-11149# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung fuer Flugversuchstechnik.
DIGITAL DATA RECORDING ON FLOPPY DISKS APPLIED FOR ON-BOARD USE IN HELICOPTERS
Rainer Holland, Horst Meyer, and Peter Pfleging May 1986 37 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-86-10; ISSN-0176-7739; ETN-86-98178) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 16.50

A direct data recording system for helicopter flight tests was developed. The system stores the flight test data in an onboard mass memory. It fulfills the requirements imposed by the high vibration level of helicopters, and by the limited space and weight possibilities. Hardware configuration, software, and terminal are described. The system can be easily built and used. Comparisons with analog data recording shows an improvement of data quality. ESA

N87-11150# National Bureau of Standards, Gaithersburg, Md.
AUTOMATED MEASUREMENT OF FREQUENCY RESPONSE OF FREQUENCY-MODULATED GENERATORS USING THE BESSEL NULL METHOD
J. R. Major, E. M. Livingston, and R. T. Adair Mar. 1986 34 p Sponsored by Army Communications-Electronics Command
(PB86-202991; NBS-TN-1093) Avail: NTIS HC A03/MF A01; also available SOD $1.75 as 003-003-02728-6 CSCL 14B

A Bessel null technique to measure the frequency response of a frequency-modulated RF carrier and a program to automate frequency response measurements of signal generators with output frequencies from 0.450 to 2000 MHz are described. The measurements obtained using the technique are more precise than those obtained by a highly trained technician using a manual system. Automated measurement of the process is desirable

since the manual method is subject to the following problems: (1) excessive time, (2) error in finding the null, and (3) lack of assurance that the null is the first Bessel null. Automated measurements can be performed using a system controller, a spectrum analyzer, a function generator, and a voltmeter (all of which must be compatible and remotely controllable). GRA

N87-11151# National Bureau of Standards, Gaithersburg, Md.
NBS (NATIONAL BUREAU OF STANDARDS) 50 kHz PHASE ANGLE CALIBRATION STANDARD Final Report
R. S. Turgel Apr. 1986 85 p Sponsored by DOD
(PB86-201274; NBS-TN-1220) Avail: NTIS HC A05/MF A01; also available SOD HC $4.00 as 003-0002726-0 CSCL 14B

A detailed description is given of the features of an electrical phase angle calibration standard designed for operation over a frequency span of 2 Hz to 50 kHz. The phase resolution of the calibrator extends from just below 2 millidegrees at the low end of the frequency range to about 5 millidegrees at the high end. The uncertainty in the phase angle is a function of frequency, amplitude, and amplitude ratio of two outputs. It varies from 5-50 millidegrees. GRA

N87-11152# Department of the Navy, Washington, D. C.
ANALOG FIBER GYRO WITH EXTENDED LINEAR RANGE Patent
William K. Burns, inventor (to Navy) and Robert P. Moeller, inventor (to Navy) Issued 4 Mar. 1986 11 p Supersedes AD-D011009 (2339212320; US-Patent-4,573,797; US-Patent-Appl-SN-583549; US-Patent-Class-356-350) Avail: US Patent and Trademark Office CSCL 17/7

A gyroscope system for obtaining an extended linear dynamic range for platform rotation rate measurements comprising a first fiber optic gyroscope with a first optical fiber coil described by a first quantity L1R1/lambda1 where L1 is the length of the first optical fiber coil, R1 is the radius of the first fiber coil, and lambda 1 is the light source wavelength, this first quantity being chosen to provide a linear output for a first range of small rotation rates of the platform; a second fiber optic gyroscope with a second optical fiber coil described by a second quantity L2R2/lambda2 with this second quantity being chosen to provide a linear output for a second range of large rotation rates of the platform, with this second range partially overlapping the first range; voltage controlled oscillators for converting the gyroscopes signals to pulse frequency signals; a circuit for determining whether a reference rotation rate within the overlap between the first and second ranges has been reached and generating a control signal in accordance therewith; a pulse counter; and a switch for switching one or the other of the pulse frequency signals to the pulse counter in accordance with the control signal so that a gyroscope which is operating within its linear range is utilized. Author (GRA)

N87-11185*# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
FURTHUR DEVELOPMENT OF THE DYNAMIC GAS TEMPERATURE MEASUREMENT SYSTEM
D. L. Elmore, W. W. Robinson, and W. B. Watkins *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11186*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF HEAT FLUX SENSORS IN TURBINE AIRFOILS
William H. Atkinson and Richard R. Strange *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER ANEMOMETERS OF HOT-SECTION APPLICATIONS
Richard G. Seasholtz, Lawrence G. Oberle, and Donald H. Weikle *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11188*# United Technologies Research Center, East Hartford, Conn.
HIGH TEMPERATURE STATIC STRAIN GAGE PROGRAM
Charles Hulse, Richard Bailey, and Howard Grant (Pratt and Whitney Aircraft, East Hartford, Conn.) *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION RESULTS OF THE 700 DEG C CHINESE STRAIN GAGES
Howard F. Hobart *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11190*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEMONSTRATION TEST OF BURNER LINER STRAIN MEASUREMENTS USING RESISTANCE STRAIN GAGES
Howard P. Grant and Wilbur L. Anderson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 16 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

N87-11275# Institute of Ocean Sciences, Sidney (British Columbia).
DEVELOPMENT OF AN IMAGING OPTICAL SPECTROMETER FOR OCEAN AND LAND REMOTE SENSING
J. F. R. Gower, G. A. Borstad, and A. B. Hollinger (Moniteq Ltd., Concord (Ontario).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 219-225 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11276# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH-SPECTRAL RESOLUTION REMOTE SENSING INSTRUMENTS DEVELOPED AND UNDER DEVELOPMENT AT CNES
P. Vermande *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 227-232 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11292# Arizona Univ., Tucson. Optical Sciences Center.
ABSOLUTE CALIBRATION OF REMOTE SENSING INSTRUMENTS
S. F. Biggar, C. J. Bruegge, B. A. Capron, K. R. Castle, M. C. Dinguirard, R. G. Holm, L. J. Lingg, Y. Mao, J. M. Palmer, A. L. Phillips et al *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 309-314 Sponsored by NASA (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11295# Scripps Institution of Oceanography, La Jolla, Calif.
CALIBRATION OF GOES-5 AND GOES-6 VISSR/VAS SHORT-WAVELENGTH CHANNELS
R. Frouin and C. Gautier *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 327-333 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11298# Technische Univ., Munich (West Germany). Faculty of Geosciences.
CALIBRATION OF MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER CHARGED COUPLE DEVICE (MOMS-CCD) DATA AND QUALITATIVE TEST USING THEMATIC MAPPER (TM) DATA
J. Henkel and H. Kaufmann (Karlsruhe Univ. (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 347-350 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N87-11153 National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
ANALYSIS OF LASER FREQUENCY STABILITY OF HETERODYNE MEASUREMENTS
W. R. C. Rowley Feb. 1986 41 p
(NPL-MOM-78; ISSN-0309-3069; ETN-86-97990) Copyright. Avail: Issuing Activity

An optical and electronic system for heterodyne comparison of lasers used as interferometric measurement standards is presented. Optical requirements are discussed and equations for the reduction in signal strength due to imperfect adjustment are given. The photodetector and amplification system are described. The measurement of wideband noise with a spectrum analyzer is treated. The relation between the optical powers of the two lasers, the signal to noise ratio, the system bandwidth, and the probability of counting errors in a heterodyne frequency measurement is explored. For the statistical characterization of frequency stability, the successive sample deviation method is outlined, and its convergence is discussed. The characteristic gradients of the logarithmic stability/time plot are indicated. The effect of laser frequency modulation is analyzed. The importance of measuring the characteristic warm-up frequency fluctuations of a laser, as a guide to its probable limitations, is assessed. ESA

N87-11154# Department of the Air Force, Washington, D.C.
METHOD AND APPARATUS FOR HIGH SPEED, SUSTAINED RECORDING OF INFRARED LASER BEAM PATTERNS Patent
Joseph M. Geary, Darius S. Vunck, Dennis C. Duneman, Ronald L. Sessions, and Charles E. Moeller, inventors (to Air Force) Issued 18 Mar. 1986 5 p Supersedes AD-D011585
(AD-D012265; US-Patent-4,577,103; US-Patent-Appl-SN-643138; US-Patent-Class-250-316.1) Avail: US Patent and Trademark Office CSCL 14/5

This patent discloses a method of photographically recording at high speed the far field pattern of a high energy infrared laser beam over a selected period of time for providing rapid repetitive samples of information on beam parameters such as far field beam intensity, jitter, and absolute beam size and power. A sample from a high energy infrared laser beam is directed into an enclosure that is light tight to visible radiation and contains an operating lensless movie camera loaded with suitable movie film. The infrared beam is focused on the film plane of the camera so that consecutive frames of the film are irradiated by the infrared beam each time the camera shutter is open. The period of irradiation is of sufficient duration to sensitize the film to visible radiation in the areas where the infrared radiation impinges on the film. The position of the camera shutter is detected and an electrical trigger signal generated just before the shutter is closed for each frame. The trigger signal is applied to appropriate circuitry which actuates a light source to generate a pulse of visible light that irradiates the film plane of the camera near the end of each shutter movement to expose each frame of the film. The exposed film strip is developed to provide a continuous record of the infrared laser beam characteristics over the selected period of time. GRA

N87-11155# Washington State Univ., Pullman. Dept. of Physics.
STABILITY OF UV OPTICAL COATINGS IN HOSTILE EXCIMER LASER ENVIRONMENTS Final Report, Jul. 1980 - Dec. 1985
M. A. Loudiana and J. T. Dickinson 15 Jun. 1986 102 p
(Contract N00014-80-C-0798)
(AD-A169406) Avail: NTIS HC A06/MF A01 CSCL 20/5

Experiments simulating the exposure of optical coating materials to excimer laser environments are reported. Included are studies of the effect of ion bombardment on SiO2 exposed to XeF2; the effect of electron bombardment on a Ag surface (clean, or under thin films of ThF4, MgF2, SiO2, or Al2O3 in the presence of XeF2 or F2; the effect of electron bombardment on ThF4 exposed to XeF2; and electron emission from F2 adsorption on tungsten, with a model for the F2 flux dependence and temperature dependence of this phenomenon. GRA

N87-11156# Lawrence Livermore National Lab., Calif.
EVOLUTION OF FREE-ELECTRON LASER DEVELOPMENT
B. E. Newman 1986 21 p Presented at the Los Angeles Symposium and Exhibition on Optical and Electro-optical Engineering, Los Angeles, Calif., 19 Jan. 1986
(Contract W-7405-eng-36)
(DE86-008748; LA-UR-86-996; CONF-860117-9) Avail: NTIS HC A02/MF A01

Recent experimental demonstrations of free-electron laser oscillators and amplifiers have verified the feasibility of these broadly tunable photon sources. We review the current status and their continuing evolution toward ever higher output power and shorter wavelengths. DOE

N87-11157# Los Alamos National Lab., N. Mex.
SINGLE-PULSE LASER EFFECTS MEASUREMENTS AT 248 nm
R. S. Dingus, R. Green, T. R. King, W. Z. Osborne, and C. R. Phipps, Jr. 1986 26 p Presented at the AIAA Laser Effects and Target Meeting, Menlo Park, Calif., 5 Nov. 1986
(Contract W-7405-eng-36)
(DE86-011229; LA-UR-86-1877; CONF-861139-1) Avail: NTIS HC A03/MF A01

We have measured induced impulse and mass loss from exposures of a number of materials to 50 ns, KrF (0.248 microns) laser pulses as a function of incident laser fluence, ambient atmospheric pressure, and angle of incidence. The energy on target was normally about 100 J but was varied down to about 10 J and the beam diameter on target was varied from about 0.1 to 38 mm providing incident laser fluences of from about 10 to the 4th power J/sq m to about 10 to the 10th power J/sq m. Calculations indicate that for fluences in these experiments below about 10 to the 7th power J/sq m, the blowoff hydrodynamics is predominately one dimensional. The ambient atmospheric pressure was varied from about 10 to the 5th power Pa of dry air to a vacuum of less than 10 to the -2 power Pa; the angle of incidence was varied from normal incidence to 10 deg from grazing incidence. In a few cases, the pressure was measured as a function of time, sometimes concurrently with impulse. A number of plasma physics measurements were also performed concurrently. DOE

N87-11031*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communication Systems Research Section.
SINGLE LONGITUDINAL MODE OPERATION OF SEMICONDUCTOR LASER ARRAYS WITH ETALON CONTROL
H. Hemmati *In its* The Telecommunications and Data Acquisition Report (date) p 66 - 69 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 17B

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N87-11158*# Mechanical Technology, Inc., Latham, N. Y.
FATIGUE LIFE OF LASER CUT METALS Final Report

Michael R. Martin Sep. 1986 54 p
(Contract NAS3-23942; DA Proj. 1L1-61102-AH-45)
(NASA-CR-179501; NAS 1.26:179501; USAAVSCOM-TR-86-C-34; MTI-86TR40) Avail: NTIS HC A04/MF A01 CSCL 13I

Fatigue tests were conducted to determine the actual reduction in fatigue life due to weight removal for balancing by: hand grinding, low power (20 watt) Nd:glass laser, and high power (400 watt) Nd:YAG laser. Author

N87-11159*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
CONTROL OF A FREE-FLYING ROBOT MANIPULATOR SYSTEM Semiannual Report, Aug. 1985 - Feb. 1986
Harold Alexander Feb. 1986 16 p
(Contract NCC2-333)
(NASA-CR-179877; NAS 1.26:179877; SAR-2) Avail: NTIS HC A02/MF A01 CSCL 05H

The development of and test control strategies for self-contained, autonomous free flying space robots are discussed. Such a robot would perform operations in space similar to those currently handled by astronauts during extravehicular activity (EVA). Use of robots should reduce the expense and danger attending EVA both by providing assistance to astronauts and in many cases by eliminating altogether the need for human EVA, thus greatly enhancing the scope and flexibility of space assembly and repair activities. The focus of the work is to develop and carry out a program of research with a series of physical Satellite Robot Simulator Vehicles (SRSV's), two-dimensionally freely mobile laboratory models of autonomous free-flying space robots such as might perform extravehicular functions associated with operation of a space station or repair of orbiting satellites. It is planned, in a later phase, to extend the research to three dimensions by carrying out experiments in the Space Shuttle cargo bay. Author

N87-11160# Ballistic Research Labs., Aberdeen Proving Ground, Md.
RADIAL EXPANSION OF CAVITIES PRODUCED BY THE AXISYMMETRIC STEADY PENETRATION OF HYPERVELOCITY RODS
Brian R. Scott Apr. 1986 115 p
(AD-A168186; BRL-TR-2722) Avail: NTIS HC A06/MF A01 CSCL 19/4

A model for the expansion of a cavity created during the penetration of high-speed rods is presented. This model was formulated by making several assumptions as to the behavior of the deforming target material during the cavity expansion process. The assumptions are supported by previous experimental and finite difference investigations. Upon specification of the matching conditions at the boundaries of the plastic deformation regions, the governing system of nonlinear field equations reduces to simpler ordinary differential equations. Initial conditions are estimated and the resulting initial value problems are solved with a standard Runge-Kutta technique. Parametric trends are subsequently established and the model predictions compare quantitatively well with experimental observations. It is concluded that the model accurately predicts the proper behavior but the accuracy of results depends significantly upon the precision with which the initial conditions and the target material characteristics may be specified. GRA

N87-11161# American Welding Inst., Louisville, Tenn.
STUDY OF THE STATUS AND POTENTIAL OF HIGH ENERGY BEAM WELDING IN SHIPYARD CONSTRUCTION
J. C. Danko Sep. 1985 85 p
(Contracts NB84RAC45137; N00014-85-G-0251)
(AD-A169281; AWI-CR-85-002) Avail: NTIS HC A05/MF A01 CSCL 13/8

This summary report presents the results of the work performed under the National Bureau of Standards contract NB84RAC45137 on the Study of the Status and Potential of High Energy Beam Welding in Shipyard Construction. The objective of this paper study was to assess the possibilities of achieving higher productivity through development of high energy beam welding processes with the intent to contribute to the reduction-to-practice of specific welding equipment and procedures. Part of this study was performed by United Technologies Research Center on laser beam welding and part by Chicago Bridge and Iron Company on electron beam welding. GRA

N87-11162# Lawrence Livermore National Lab., Calif.
DEVELOPMENT OF PRECISION TURNING CAPABILITIES AT LAWRENCE LIVERMORE NATIONAL LABORATORY
S. R. Patterson 12 Jun. 1986 17 p Presented at the 3rd Biennial International Machine Tool Technical Conference, Chicago, Ill., 3 Sep. 1986
(Contract W-7405-eng-48)
(DE86-011884; UCRL-94719; CONF-860981-1) Avail: NTIS HC A02/MF A01

A large vertical turning machine with accuracy approaching one microinch and capabilities to produce nonaxisymmetric workpieces has been developed. Accuracy is achieved through the application of rigid environmental controls, the use of high-resolution laser interferometer feedback, and the application of a supermini computer control system. The machine is actively corrected for variations in bearing performance and machine frame distortion. The ability to introduce fixed amounts of tool motion synchronous with spindle rotation permits correction for workpiece and fixturing centrifugal distortion as well as the production of intentionally nonground workpieces. Increasingly sophisticated and cost-effective microcomputers and a new generation of commercial laser interferometers make the techniques applied to this prototype research machine of interest for future commercial high-precision machine tools. DOE

N87-11163# Department of Energy, Washington, D. C.
AUTOMOTIVE TECHNOLOGY DEVELOPMENT PROGRAM Annual Report To Congress
Dec. 1985 24 p
(Contract DE-AI01-82CS-50286)
(DE86-010883; DOE/CE-0027/4; AR-7) Avail: NTIS HC A02/MF A01

DOE's Automotive Technology Development Program consists of three major engine-related projects: (1) the Automotive Gas Turbine Engine Development Project, (2) the Automotive Stirling Engine Development Project, and (3) the Heavy Duty Transport Technology Project. In addition, basic ceramic materials technology for all engine projects is being developed under the Advanced Materials Development Project. DOE

N87-11164# Air Products and Chemicals, Inc., Allentown, Pa. Advanced Products Dept.
CONCEPTUAL DESIGN OF GTA-1 NEUTRALIZER CRYOPUMP Final Report
R. C. Longsworth and W. A. Steyert 17 Jun. 1986 127 p
(Contract W-7405-eng-36)
(DE86-011759; LA/Sub-D2121G-1) Avail: NTIS HC A07/MF A01

Design studies were carried out on a cryopump for freezing out argon (or N2 or Xe) as it flows at the average rate .05 g/s from each end of a 30 cm diameter injection tube. Conductive and gas cooled cryopanels were studied with the latter recommended. The recommended design consists of a 6 m long vacuum enclosure, consisting of two 46 cm diameter x 2.5 m long tubes containing cylindrical cryopanels which connect to a central housing that contains the injection tube and refrigerator assembly. The refrigeration system consists of six standard Gifford McMahon (GM) cycle refrigerators with remote compressors having a capacity of 39 watts at 20 K plus 120 watts at 77 K for each end, the total being twice this. The cryopanels are cooled by circulating cold helium from the refrigerator system. When pumping argon, there is 27% excess refrigeration at 20 K and 38% at 77 K while for nitrogen there is only a few percent margin. Xenon imposes a lower load than argon. The proposed length of 6 m exceeds the preliminary design goal by 1 m to allow for an additional

section of 77 K cryopanel at the beam ends of the cryopump to intercept thermal radiation from the beam tubes. The cost of the system is estimated to be $202,500 and requires six months to fabricate and test. DOE

N87-11165# Lawrence Livermore National Lab., Calif.
DESIGN AND PERFORMANCE OF A SMALL PRECISION CNC TURNING MACHINE
R. R. Donaldson and D. C. Thompson 26 Feb. 1986 18 p Presented at the 36th International Institution for Production Engineering Research General Assembly, Jerusalem, Israel, 16 Aug. 1986
(Contract W-7405-eng-48)
(DE86-008032; UCRL-94173; CONF-860839-1) Avail: NTIS HC A02/MF A01

This paper describes the design of a computerized numerical control (CNC) turning machine that is capable of machining workpieces up to 100 mm in diameter with a high contour accuracy and a very low surface roughness. Two nearly identical machines have been built and put into operation using this design, one for serial parts manufacture and the other for research into improving the accuracy of single-point machining; information based on this operational experience is also presented. The first machine has demonstrated an accuracy of 0.1 micron peak-to-valley on contoured workpieces, while the second machine has produced surface roughnesses of 1 nm rms in flat facing of electroless nickel with a diamond tool. DOE

N87-11166# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fluid Technology.
HEAT EXCHANGEABLE LIQUID INJECTED COMPRESSORS
Jan-Gunnar Persson 30 Jan. 1986 77 p
(ETN-86-97852) Avail: NTIS HC A05/MF A01

Oil and water injection in an air compressor were studied. Water vaporization is found to have a minor influence on cooling in a high speed compressor. The importance of a high liquid surface/volume ratio (i.e., a highly atomized liquid) is clearly seen. The energy requirement for atomization is very high for small droplets, however. The gain in compression power reduction due to injection of a fine spray is counterbalanced by the power required for atomization of the liquid. Experimental results indicate that the droplets form a liquid film, with a much lower surface/volume ratio on the compressor rotors and housing. The main advantage of liquid injection is the improved sealing and cooling of the compressor parts. ESA

N87-11167# British Aerospace Public Ltd. Co., Bristol (England).
A SUMMARY OF GAS SHIELDED ARC WELDING
J. W. Henn Dec. 1982 15 p
(BAe-BT-14107; LR47662; ETN-86-97962) Avail: NTIS HC A02/MF A01

Shielded metal arc weld positions; type of joints; starting the arc; current setting; arc length; travel speed; crater formation; electrode position; and single and multiple pass welds are discussed. Metal inert gas welding current; types of metal transfer; and practical considerations are treated. ESA

N87-11168# British Aerospace Public Ltd. Co., Bristol (England). Mechanical Equipment Dept.
PERFORMANCE CHARACTERISTICS OF A LOW SPEED HYDRAULIC MOTOR DRIVING A POSITION CONTROL SYSTEM
P. J. Gilder Jul. 1983 221 p
(BAe-BT-14978; Inform-Sheet-587; LR48758; ETN-86-97969) Avail: NTIS HC A10/MF A01

A radial piston motor was used in the servo system of a launcher turntable. The motor's internal friction forces were analyzed to calculate the effect of shaft angle and back pressure on developed torque. Equations to model torque and flow losses over the motor's whole operating range were derived. Computer models of the hydraulic motor, (rotary) load and servo amplifier were developed. A test rig was used to investigate the effect of shaft angular position, pressure rise rate, and inlet and outlet pressure on available starting torque. The motor operates with high efficiency under normal operating conditions and rotates smoothly at very low speeds. The frequency response is similar to that of the standard drive unit and the motor can rotate the turntable very smoothly at low speeds under closed loop control. ESA

N87-11169# Sheffield Univ. (England). Dept. of Control Engineering.
IMAGE BASED VISUAL SERVO CONTROL OF A REVOLUTE-COORDINATE (ARM AND ELBOW) ROBOT
A. S. Morris and G. E. Deacon Jan. 1986 26 p
(RR-288; ETN-86-98023) Avail: NTIS HC A03/MF A01

A technique of using an image feature vector directly as the feedback control parameters in a robot driving strategy is described. This avoids the calculation of the inverse kinematic relationships involved in robot driving algorithms based on robot vision systems, and so means a massive reduction in computational effort. The technique is applicable irrespective of the type of camera used in the vision system. ESA

N87-11170# Technische Hochschule, Aachen (West Germany).
APPLICATION OF THE FINITE ELEMENT METHOD TO THE THERMOMECHANICAL ANALYSIS OF DIRECT-FIBER-PREFORM FORGING: POSSIBILITIES AND EXAMPLES [EINSATZ DER METHODE DER FINITEN ELEMENTE BEI DER THERMOMECHANISCHEN ANALYSE DES FREIFORMSCHMIEDENS: MOEGLICHKEITEN UND BEISPIELE]
G. Hirt, M.-L. Cho, and J. Luginsland 1985 6 p In GERMAN Presented at Umformtechnik 85 Stahlkolloquium, Aachen, West Germany Sponsored by Deutsche Forschungsgemeinschaft
(ETN-86-97826) Avail: NTIS HC A02/MF A01

The possibilities of the finite element method (FEM) for the thermomechanical simulation of processes are demonstrated by the process of direct fiber preform forging. The thermomechanical simulation calculates the thermal and plastomechanical evolution of the recasting process. Examples show good agreement with experimental data; the comparison with experiments is used to find improved friction boundary condition assumptions. Problems related to thermomechanical calculations are discussed. The results of the calculations demonstrate that their quality essentially depends on the accuracy of the given boundary conditions and on the materials data. ESA

N87-11171# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON ROBOTS WITH FLEXIBLE LINKS: DYNAMICS, CONTROL AND STABILITY
Joost J. Kalker and Geert Jan Olsder 1 Oct. 1985 19 p
(Rept-85-34; ETN-86-98464) Avail: NTIS HC A02/MF A01

It is shown that a possibly redundant robot with rigid links driven at the nodes can be stabilized for any feasible, given path of the nodes. This result is generalized to robots with stiff yet flexible links. The Lagrangean equations of motion are used to describe the robot. The controls are the polygenic generalized forces corresponding to the Lagrangean coordinates. The stabilizing controls are exhibited. ESA

N87-11172# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
COMPUTER AIDED DESIGN OF ROBOT MANIPULATORS AND THEIR OPERATIONS
R. J. P. Groothuizen and R. F. vanderWijngaart 2 Apr. 1985 30 p In DUTCH and ENGLISH Presented at the CAPE '85 Nederland Congress on Computer Applications in Production and Engineering, Amsterdam, Netherlands, 2 May 1985
(NLR-MP-85012-U; B8667023; ETN-86-98488) Avail: NTIS HC A03/MF A01

Analytical design methods were used for the design and simulation of robot manipulators. The formulas describing explicitly the kinematics and dynamics of robot manipulators are too large for generation by hand; therefore the benefits of symbolic formula manipulation for generation of these formulas are discussed. It is shown that formulas describing the kinematic aspects can be easily

generated. However, as to the dynamics aspects, the formulas have first to be simplified analytically before generation becomes feasible; this is shown to be possible. A model for a design system for robot manipulators based on these explicit formulas is discussed. ESA

N87-11173# Technische Hogeschool, Eindhoven (Netherlands). Div. of Production Technology and Automation.
THE PREDICTION OF TOOL PRESSURES IN COINING
J. A. H. Ramaekers and S. Hoogenboom Nov. 1984 7 p
(WPB-0132; ETN-86-98530) Avail: NTIS HC A02/MF A01

Compression of a blank between flat punches to study the pressing of sharp edges at the rim of the coin, and compression of a blank with a punch provided with conical engravings are described. Tool load prediction methods based on plasticity theory are presented. Measurements show that tool loads can reach values 5 to 10 times the yield stress of the product material. Theoretical results suggest that the tool load at the end of the process tends to infinity. In practice the tools and press deform elastically. The influence of friction is equivocal. Because of the relatively small slip, the friction shear stress is small, but minor local disturbances of the lubrication can cause high local pressures or poor filling of the engraving. ESA

N87-11174 Clemson Univ., S.C.
CHARACTERIZATION AND CONTROL OF OBJECT ACQUISITION USING A ROBOT HAND Ph.D. Thesis
Joey Keith Parker 1985 339 p
Avail: Univ. Microfilms Order No. DA8607364

Many industrial robots require an end-effector or robot hand for acquiring and grasping objects to perform desired functions such as part loading/unloading and assembly. An understanding of the important considerations in robot hand design is crucial to these industrial tasks since the hand represents the link between the robot system and the manufacturing operation or activity. This understanding has been developed by: (1) identifying and characterizing fundamental principles which govern how robot hands behave during the object acquisition process, then (2) designing and evaluating a proof-of-concept robot hand which demonstrated these principles by acquiring a wider range of objects than present industrial robot hands. The object acquisition process is divided into four stages, and the important design aspects of each stage are developed. Object position and orientation information must be obtained by programming or through sensors for successful object acquisition. Other fundamental aspects are the hand, object, and environmental characteristics which influence robot hand design requirements. Control considerations include the frequent need for simultaneous force and position control of a grasped object, and the control of object robot hand finger impact velocity as the only flexible method for limiting impact forces with robot hands. A two-fingered, microcomputer controlled robot hand was designed, fabricated and tested. With the aid of sensors the proof-of-concept hand is capable of successfully acquiring a variety of objects, from light bulbs to heavy and bulky steel billets, in a controlled manner. Dissert. Abstr.

N87-11504# Fraunhofer-Inst. fuer Arbeitswirtschaft und Organisation, Stuttgart (West Germany).
EVALUATION STUDY OF THE INDIRECT-SPECIFIC FUNDING FOR THE DEVELOPMENT OF INDUSTRIAL ROBOTS, MANIPULATION SYSTEMS, AND THEIR INTELLIGENT PERIPHERY [WIRKUNGSANALYSE DER INDIREKT-SPEZIFISCHEN FOERDERUNG ZUR ENTWICKLUNG VON INDUSTRIEROBOTERN, HANDHABUNGSSYSTEMEN SOWIE ZUGEHOERIGER INTELLIGENTER PERIPHERIE]
R. Bruening, R. Friedrich, and V. Korndoerfer *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 111-141 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

N87-11505# Fraunhofer-Inst. fuer Productionstechnik und Automatisierung, Stuttgart (West Germany).
TECHNICAL AND ORGANIZATIONAL CONCEPTS OF THE APPLICATION OF INDUSTRIAL ROBOTS AND MANIPULATION SYSTEMS (IR/HHS). EXPERIENCES OF THE CONSULTANT CENTER FOR INDUSTRIAL ROBOTS (BZI) [TECHNISCHE AND ORGANISATORISCHE KONZEPTION DES IR/HHS-EINSATZES. ERFAHRUNGEN DES BERATERZENTRUM INDUSTRIEROBOTER (BZI)]
Guenter Schiele *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 143-166 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N87-11175 Cirrus Computers Ltd., Fareham (England).
INVESTIGATION OF OPTIMAL COMPLEXITY OF BITE AND ITS EFFECTS ON RELIABILITY, MAINTAINABILITY, MONITORING AND FAULT PREDICTION
W. R. Moore and R. I. Damper Mar. 1984 47 p
(ETN-86-97976) Copyright. Avail: Issuing Activity

The application of Built-in-Test (BIT) techniques in the maintenance of military and aircraft electronic systems is reviewed. Despite the relative ease with which BIT can be added, and the apparently good performance claimed by designers, there are clear indications that BIT very often fails in practice in its aims of easy maintainability with lowskilled labor. A particular problem is the rate of false-alarms, where fault-free units are removed unnecessarily and there is evidence that the overall maintenance costs could be lower with less sophisticated BIT. The optimum level of BIT is, however, very difficult to predict and a convincing case can be made for the BIT specification to be developed in an interactive way throughout the course of design, development, commissioning and field operation, in the light of the available technology and of the whole maintenance strategy. Against this background, BIT deployment is seen as much a management problem, as a technical one. ESA

N87-11176# Royal Aircraft Establishment, Farnborough (England).
NON-DESTRUCTIVE METHODS OF CHARACTERISING THE STRENGTH OF ADHESIVE-BONDED JOINTS
D. E. W. Stone 7 Oct. 1985 11 p
(RAE-TM-MAT/STR-1065; BR98350; ETN-86-97993) Avail: NTIS HC A02/MF A01

The lack of adequate nondestructive methods to check bond quality of adhesive-bonded joints is discussed. For joints with composite adherends it is concluded that surface contamination prior to bonding must be sought, environmental degradation is not a major problem. With metallic adherends, adhesive strength strongly depends on the detailed nature of the thin oxide layer and the way in which this becomes hydrated causing environmental degradatation. Ultrasonic methods offer the best prospects but it is shown that sophisticated procedures are necessary. ESA

N87-10922# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACECRAFT LOAD, DESIGN AND TEST PHILOSOPHIES
Ben K. Wada *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 271-276 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-11197*# Garrett Corp., Phoenix, Ariz.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT

T. E. Strangman *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

N87-11198*# General Electric Co., Fairfield, Conn.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT
R. V. Hillery *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 3 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

N87-11199*# Pratt and Whitney Aircraft, East Hartford, Conn.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT
Jeanine DeMasi and Keith Sheffler *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

N87-11213*# Pratt and Whitney Aircraft, East Hartford, Conn.
CREEP FATIGUE LIFE PREDICTION FOR ENGINE HOT SECTION MATERIALS (ISOTROPIC): TWO YEAR UPDATE
Vito Moreno *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
(Contract NAS3-23288)
Avail: NTIS HC A17/MF A01 CSCL 14D

N87-11215*# Syracuse Univ., N. Y. Dept. of Mechanical Engineering.
OXIDATION AND LOW CYCLE FATIGUE LIFE PREDICTION
Yoshiki Oshida and Hao-Wen Liu *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 9 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11D

N87-11218*# Pratt and Whitney Aircraft, East Hartford, Conn.
LIFE PREDICTION AND CONSTITUTIVE MODELS FOR ENGINE HOT SECTION ANISOTROPIC MATERIALS
Gustav A. Swanson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N87-11177*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURAL BEHAVIOR OF THE SPACE SHUTTLE SRM TANG-CLEVIS JOINT
William H. Greene, Norman F. Knight, Jr., and Alan E. Stockwell (PRC Kentron, Inc., Hampton, Va.) Sep. 1986 32 p
(NASA-TM-89018; NAS 1.15:89018) Avail: NTIS HC A03/MF A01 CSCL 20K

The space shuttle Challenger accident investigation focused on the failure of a tang-clevis joint on the right solid rocket motor. The existence of relative motion between the inner arm of the clevis and the O-ring sealing surface on the tang has been identified as a potential contributor to this failure. This motion can cause the O-rings to become unseated and therefore lose their sealing capability. Finite element structural analyses have been performed to predict both deflections and stresses in the joint under the primary, pressure loading condition. These analyses have demonstrated the difficulty of accurately predicting the structural behavior of the tang-clevis joint. Stresses in the vicinity of the connecting pins, obtained from elastic analyses, considerably exceed the material yield allowables indicating that inelastic analyses are probably necessary. Two modifications have been proposed to control the relative motion between the inner clevis arm and the tang at the O-ring sealing surface. One modification, referred to as the capture feature, uses additional material on the inside of the tang to restrict motion of the inner clevis arm. The other modification uses external stiffening rings above and below the joint to control the local bending in the shell near the joint. Both of these modifications are shown to be effective in controlling the relative motion in the joint. Author

N87-11178*# Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering.
PASSIVE DAMPING CONCEPTS FOR SLENDER COLUMNS IN SPACE STRUCTURES Progress Report, period ending 1 Feb. 1985
Zia Razzaq Feb. 1985 12 p
(Grant NAG1-336)
(NASA-CR-179807; NAS 1.26:179807) Avail: NTIS HC A02/MF A01 CSCL 20K

Research into the identification of potential passive damping concepts for use in very slender structural members was continued. The following damping concepts are under investigation: mass-string dampers; bright zinc chain; polyethylene tubing; external viscoelastic tape; brushes for electrostatic and frictional damping; suspended chambers with oil and discs; and hybrid concepts. Each of these concepts are briefly discussed. Author

N87-11179*# Vigyan Research Associates, Inc., Hampton, Va.
STRESS ANALYSIS OF PATHFINDER-2 MODELS Final Report, 28 Feb. 1980 - 30 Jun. 1984
S. C. Mehrotra and C. T. L. Mills Oct. 1984 39 p
(Contract NAS1-16114)
(NASA-CR-172458; NAS 1.26:172458) Avail: NTIS HC A03/MF A01 CSCL 20K

Stress analysis of the Pathfinder 2 fighter model was performed to determine a method for leading- and trailing-edge attachment that gives acceptable stress levels. Structural modeling of the wing was done using the finite element code SPAR. For the models studied, one ordinary lap joint was found to be satisfactory for the leading-edge flap, however, the alternating surface segmented lap joint method fo attachment was necessary for the trailing-edge flap to obtain acceptable stress levels. Author

N87-11180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE ENGINE HOT SECTION TECHNOLOGY, 1984
Oct. 1984 400 p Conference held in Cleveland, Ohio, 23-24 Oct. 1984
(NASA-CP-2339; E-2267; NAS 1.55:2339) Avail: NTIS HC A17/MF A01 CSCL 20K

Presentations were made concerning the hot section environment and behavior of combustion liners, turbine blades, and waves. The presentations were divided into six sessions: instrumentation, combustion, turbine heat transfer, structural analysis, fatigue and fracture, and surface properties. The principal objective of each session was to disseminate research results to date, along with future plans. Topics discussed included modeling of thermal and fluid flow phenomena, structural analysis, fatigue and fracture, surface protective coatings, constitutive behavior, stress-strain response, and life prediction methods. For individual titles, see N87-11181 through N87-11225.

N87-11181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION OVERVIEW c25
Donald F. Schultz *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21B

The objective of this effort is to develop improved analytical

models of the internal combustor flow field and liner heat transfer as a means to shorten combustor development time and increase turbine engine hot section life. A four-element approach was selected to meet this objective. First, existing models were utilized to determine their deficiencies. Supporting research was then commenced to improve the exisiting models. While the research effort is in progress, the models are being refined to improve numerics and numerical diffusion. And lastly, the research results and improved numerics will be integrated into existing models.
Author

N87-11182*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE PROTECTION **c26**
Stanley R. Levine *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11F

The surface protection subproject consists of three major thrusts: airfoil deposition model; metallic coating life prediction; and thermal barrier coating (TBC) life prediction. The time frame for each of these thrusts and the expected outputs are presented. Further details are given for each thrust such as specific element schedules and the status of performance; in-house, via grant, or via contract.
B.G.

N87-11183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE AND FRACTURE: OVERVIEW
G. R. Halford *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

A brief overview of the status of the fatigue and fracture programs is given. The programs involve the development of appropriate analytic material behavior models for cyclic stress-strain-temperature-time/cyclic crack initiation, and cyclic crack propagation. The underlying thrust of these programs is the development and verification of workable engineering methods for the calculation, in advance of service, of the local cyclic stress-strain response at the critical life governing location in hot section compounds, and the resultant crack initiation and crack growth lifetimes.
B.G.

N87-11184*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOST TURBINE HEAT TRANSFER OVERVIEW **c34**
John E. Rohde *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

Improved methods of predicting airfoil local metal temperatures require advances in the understanding of the physics and methods of analytically predicting the following four aerothermal loads: hot gas flow over airfoils, heat transfer rates on the gas-side of airfoils, cooling air flow inside airfoils, and heat transfer rates on the coolant-side of airfoils. A systematic building block research approach is being pursued to investigate these four areas of concern from both the experimental and analytical sides. Experimental approaches being pursued start with fundamental experiments using simple shapes and flat plates in wind tunnels, progress to more realistic cold and hot cascade tests using airfoils, continue to progress in large low-speed rigs and turbines and warm turbines, and finally, combine all the interactive effects in tests using real engines or real engine type turbine rigs. Analytical approaches being pursued also build from relatively simple steady two dimensional inviscid flow and boundary layer heat transfer codes to more advanced steady two and three dimensional viscous flow and heat transfer codes. These advanced codes provide more physics to model better the interactive effects and the true real-engine environment.
Author

N87-11185*# Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
FURTHUR DEVELOPMENT OF THE DYNAMIC GAS TEMPERATURE MEASUREMENT SYSTEM **c35**
D. L. Elmore, W. W. Robinson, and W. B. Watkins *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

Candidate concepts capable of generating dynamic temperatures were identified and analyzed for use in verifying experimentally the frequency response of the dynamic gas temperature measurement system. A rotating wheel concept and one other concept will be selected for this purpose. Modifications to the data reduction code algorithms developed were identified and evaluated to reduce substantially the data reduction execution time. These modifications will be incorporated in a new data reduction program to be written in FORTRAN IV.
Author

N87-11186*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF HEAT FLUX SENSORS IN TURBINE AIRFOILS **c35**
William H. Atkinson and Richard R. Strange *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

The objective is to develop heat flux sensors suitable for use on turbine airfoils and to verify the operation of the heat flux measurement techniques through laboratory experiments. The requirements for a program to investigate the measurement of heat flux on airfoils in areas of strong non-one-dimensional flow were also identified.
B.G.

N87-11187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER ANEMOMETERS OF HOT-SECTION APPLICATIONS **c35**
Richard G. Seasholtz, Lawrence G. Oberle, and Donald H. Weikle *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

Laser anemometers are being developed for use in the turbine facilities at Lewis that are involved in the Turbine Engine Hot Section Technology Program. The status of the program is given along with some results accomplished since 1983.
B.G.

N87-11188*# United Technologies Research Center, East Hartford, Conn.
HIGH TEMPERATURE STATIC STRAIN GAGE PROGRAM **c35**
Charles Hulse, Richard Bailey, and Howard Grant (Pratt and Whitney Aircraft, East Hartford, Conn.) *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

Development of electrical resistance strain gages for static strain measurements of nickel or cobalt superalloy parts inside a gas turbine engine on a test stand was inititated. Measurements of this type are of great importance because without reliable knowledge of the stresses and strains which exist in specific components, it will be difficult to fully appreciate where improvements in design and materials can be implemented. The first part of this effort consists of a strain gage alloy development program which will be followed by an investigation of complete strain gage systems. Efforts to date are summarized.
B.G.

N87-11189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION RESULTS OF THE 700 DEG C CHINESE STRAIN GAGES **c35**
Howard F. Hobart *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

There is a continuing interest and need for resistance strain gages capable of making static strain measurements on components located in the hot section of gas turbine engines. A paper by Tsen-tai Wu describes the development and evaluation of high temperature gauges fabricated from specially developed Fe-Cr-Al-V-Ti-Y alloy wire. Several of these gages and a quantity of P12-2 ceramic adhesive were purchased for evaluation. Nine members of the aircraft turbine engine community were invited to participate in an evaluation of these gages. Each participant was sent one strain gage, a small amount of ceramic adhesive, instructions for mounting the gage on a test beam, and a set of suggestions for the experiment. Data on gage factor variation with temperature, apparent strain, and drift are discussed. Author

N87-11190*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEMONSTRATION TEST OF BURNER LINER STRAIN MEASUREMENTS USING RESISTANCE STRAIN GAGES c35
Howard P. Grant and Wilbur L. Anderson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 16 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14B

A demonstration test of burner liner strain measurements using resistance strain gages as well as a feasibility test of an optical speckle technique for strain measurement are presented. The strain gage results are reported. Ten Kanthal A-1 wire strain gages were used for low cycle fatigue strain measurements to 950 K and .002 apparent strain on a JT12D burner can in a high pressure (10 atmospheres) burner test. The procedure for use of the strain gages involved extensive precalibration and postcalibration to correct for cooling rate dependence, drift, and temperature effects. Results were repeatable within + or - .0002 to .0006 strain, with best results during fast decels from 950 K. The results agreed with analytical prediction based on an axisymmetric burner model, and results indicated a non-uniform circumferential distribution of axial strain, suggesting temperature streaking. Author

N87-11191*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.
TURBINE AIRFOIL DEPOSITION MODELS c07
Daniel E. Rosner *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 22 p (For primary document see N87-11180 02-39)
(Grant NAG3-201)
Avail: NTIS HC A17/MF A01 CSCL 21E

Gas turbine failures associated with sea-salt ingestion and sulfur-containing fuel impurities have directed attention to alkali sulfate deposition and the associated hot corrosion of gas turbine (GT) blades under some GT operating conditions. These salt deposits form thin, molten films which undermine the protective metal oxide coating normally found on GT blades. The prediction of molten salt deposition, flow and oxide dissolution, and their effects on the lifetime of turbine blades are examined. Goals include rationalizing and helping to predict corrosion patterns on operational GT rotor blades and stators, and ultimately providing some of the tools required to design laboratory simulators and future corrosion-resistant high-performance engines. Necessary background developments are reviewed first, and then recent results and tentative conclusions are presented along with a brief account of the present research plans. Author

N87-11192*# Analex Corp., Dayton, Ohio.
EXPERIMENTAL VERIFICATION OF VAPOR DEPOSITION MODEL IN MACH 0.3 BURNER RIGS c26
Sueleyman A. Goekoglu *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 13 p (For primary document see N87-11180 02-39)
(Contract NAS3-23293)
Avail: NTIS HC A17/MF A01 CSCL 11F

A comprehensive theoretical framework of deposition from combustion gases was developed covering the spectrum of various mass delivery mechanisms including vapor, thermophoretically enhanced small particle, and inertially impacting large particle deposition. Rational yet simple correlations were provided to facilitate engineering surface arrival rate predictions. Experimental verification of the deposition theory was validated using burner rigs. Toward this end, a Mach 0.3 burner rig apparatus was designed to measure deposition rates from salt-seeded combustion gases on an internally cooled cylindrical collector. B.G.

N87-11193*# General Electric Co., Fairfield, Conn.
EFFECTS OF SURFACE CHEMISTRY ON HOT CORROSION LIFE c26
R. E. Fryxell and B. K. Gupta (TRW, Inc., Cleveland, Ohio) *In* NASA. Lewis Research Center Turbine Engine Hote Section Technology, 1984 Oct. 1984 14 p (For primary document see N87-11180 02-39)
(Contract NAS3-23926)
Avail: NTIS HC A17/MF A01 CSCL 11F

Hot corrosion life prediction methodology based on a combination of laboratory test data and field service turbine components, which show evidence of hot corrosion, were examined. Components were evaluated by optical metallography, scanning electron microscopy (SEM), and electron micropulse (EMP) examination. B.G.

N87-11194*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COATING LIFE PREDICTION c27
James A. Nesbitt and Michael A. Gedwill *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11G

Hot-section gas-turbine components typically require some form of coating for oxidation and corrosion protection. Efficient use of coatings requires reliable and accurate predictions of the protective life of the coating. Currently engine inspections and component replacements are often made on a conservative basis. As a result, there is a constant need to improve and develop the life-prediction capability of metallic coatings for use in various service environments. The purpose of this present work is aimed at developing of an improved methodology for predicting metallic coating lives in an oxidizing environment and in a corrosive environment. Author

N87-11195*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRODUCTION TO LIFE MODELING OF THERMAL BARRIER COATINGS c27
Robert A. Miller *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11G

Thermal barrier coatings may be applied to air-cooled turbine section airfoils to insulate such components from hot gases in the engine. The coatings, which typically consist of about 0.01 to 0.04 cm of zirconia-yttria ceramic over about 0.01 cm of NiCrAlY or NiCrAlZr alloy bond coat, allow increased gas temperatures or reduced cooling air flows. This, in turn, leads to marked improvements in engine efficiency and performance. However, certain risks are associated with designing for maximum benefits, and eventually a point is reached where coating loss would immediately jeopardize the underlying component. Therefore, designers must be able to accurately predict the life of a given bill-of-material coating in any particular design. The results of an in-house aeronautics, base research and technology program which is designed to provide the first steps towards developing mission-capable life-prediction models are outlined. Author

N87-11196*# Cleveland State Univ., Ohio.
MECHANICAL BEHAVIOR OF THERMAL BARRIER COATINGS FOR GAS TURBINE BLADES c07
Christopher C. Berndt, Woraphat Phucharoen, and George C. Chang *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
(Contract NCC3-27)
Avail: NTIS HC A17/MF A01 CSCL 21E

Plasma-sprayed thermal barrier coatings (TBCs) will enable turbine components to operate at higher temperatures and lower cooling gas flow rates; thereby improving their efficiency. Future developments are limited by precise knowledge of the material properties and failure mechanisms of the coating system. Details of this nature are needed for realistic modeling of the coating system which will, in turn, promote advancements in coating technology. Complementary experiments and analytical modeling which were undertaken in order to define and measure the important failure processes for plasma-sprayed coatings are presented. The experimental portion includes two different tests which were developed to measure coating properties. These are termed tensile adhesion and acoustic emission tests. The analytical modeling section details a finite element method which was used to calculate the stress distribution in the coating system. Some preliminary results are presented. Author

N87-11197*# Garrett Corp., Phoenix, Ariz.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT **c38**
T. E. Strangman *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

Thermal barrier coatings (TBCs) for turbine airfoils in high-performance engines represent an advanced materials technology that has both performance and durability benefits. In order to achieve these benefits, however, the TBC system must be reliable. Prediction of the lives of two types of strain-tolerant and oxidation-resistant TBC systems that are produced by commercial coating suppliers to the gas turbine industry is examined. The plasma sprayed TBC system, composed of a low-pressure plasma spray (LPPS) applied oxidation resistant NiCrAlY bond coating and an air-plasma-sprayed yttria (8 percent) partially stabilized zirconia insulative layer is applied by both Chromalloy and Klock. The second type of TBC is applied by the electron beam-physical vapor depositon (EB-PVD) process by Temescal. B.G.

N87-11198*# General Electric Co., Fairfield, Conn.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT **c38**
R. V. Hillery *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 3 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

In order to fully exploit thermal barrier coatings (TBCs) on turbine components and achieve the maximum performance benefit, the knowledge and understanding of TBC failure mechanisms must be increased and the means to predict coating life developed. The proposed program will determine the predominant modes of TBC system degradation and then develop and verify life prediction models accounting for those degradation modes. The successful completion of the program will have dual benefits: the ability to take advantage of the performance benefits offered by TBCs, and a sounder basis for making future improvements in coating behavior. Author

N87-11199*# Pratt and Whitney Aircraft, East Hartford, Conn.
THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT **c38**
Jeanine DeMasi and Keith Sheffler *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

The objective of this program is to develop an integrated life prediction model accounting for all potential life-limiting Thermal Barrier Coating (TBC) degradation and failure modes including spallation resulting from cyclic thermal stress, oxidative degradation, hot corrosion, erosion, and foreign object damage (FOD). The mechanisms and relative importance of the various degradation and failure modes will be determined, and the methodology to predict predominant mode failure life in turbine airfoil application will be developed and verified. An empirically based correlative model relating coating life to parametrically expressed driving forces such as temperature and stress will be employed. The two-layer TBC system being investigated, designated PWA264, currently is in commercial aircraft revenue service. It consists of an inner low pressure chamber plasma-sprayed NiCoCrAlY metallic bond coat underlayer (4 to 6 mils) and an outer air plasma-sprayed 7 w/o Y2O3-ZrO2 (8 to 12 mils) ceramic top layer. B.G.

N87-11200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROTHERMAL MODELING PROGRAM, PHASE 2 **c07**
Edward J. Mularz *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

The accuracy and utility of current aerothermal models for gas turbine combustors must be improved. Three areas of concern are identified: improved numerical methods for turbulent viscous recirculating flows; flow interaction; and fuel injector-air swirl characterization. Progress in each area is summarized. B.G.

N87-11201*# United Technologies Research Center, East Hartford, Conn.
MASS AND MOMENTUM TURBULENT TRANSPORT EXPERIMENTS **c34**
B. V. Johnson and R. Roback *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
(Contract NAS3-22771)
Avail: NTIS HC A17/MF A01 CSCL 20D

An experimental study of mixing downstream of axial and swirling coaxial jets is being conducted to obtain data for the evaluation and improvement of turbulent transport models currently employed in a variety of computational procedures used throughout the propulsion community. Effort was directed toward the acquisition of length scale and dissipation rate data that will provide more accurate inlet boundary conditions for the computational procedures and a data base to evaluate the turbulent transport models in the near jet region where recirculation does not occur. Mass and momentum turbulent transport data with a blunt inner-jet inlet configuration will also be acquired. B.G.

N87-11202*# Garrett Corp., Phoenix, Ariz.
NASA DILUTION JET MIXING, PHASE 3 **c34**
R. Srinivasan, G. Myers, and C. White *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

Many of the gas turbine combustors in operation use multiple rows of dilution jets, and some have geometries that are different from circular holes. The data base available in literature is generally applicable to a single row of circular holes. Tests were performed with uniform mainstream conditions for several orifice plate configurations. Temperature and pressure measurements were made in the test section at 4 axial and 11 transverse stations. These measurements were made with a 60-element rake probe. Test results for some of these cases are discussed. B.G.

N87-11203*# Oklahoma State Univ., Stillwater.
LATERAL JET INJECTION INTO TYPICAL COMBUSTOR FLOWFIELDS **c07**
David G. Lilley *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

The trajectory, penetration and mixing efficiency of lateral air jet injection into typical combustor flowfields in the absence of combustion were investigated so as to characterize the time-mean and turbulence flowfield for a variety of configurations and input parameters, recommend appropriate turbulence model advances, and implement and exhibit results of flowfield predictions. A combined experimental and theoretical approach was followed, in a modified version of the test facility, equipped initially with one

and two lateral jets, located one test-section downstream of the inlet. B.G.

N87-11204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLAME RADIATION **c25**
J. D. Wear *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21B

Total radiation and heat flux data was obtained on a combustor liner by advanced instrumentation. If the results obtained by the special instrumentation are considered to be representative of the total radiation and heat flux, then the effect of variation of engine operating parameters and of fuel type can be more easily obtained. The special instrumentation used for these investigations consisted of five total radiometers and two total heat flux gages. The radiometers were arranged axially and circumferentially through sliding air seals in the outer liner. The two heat flux gages were welded in the outer liner between two circumferential radiometers. Static pressures were obtained on both the cold and the hot side of the outer liner in the area of the heat flux gages. Liner metal temperatures were also obtained. The combustor inlet pressure was varied over a nominal range of 0.5 to 2.07 MPa, inlet air temperature from 550 to 670 K, and fuel-air ratio from about 0.015 to 0.040. The two fuels tested were ASTM Jet A and a fuel designated as ERBS V. Results of the tests are discussed. B.G.

N87-11205*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
BURNER LINER THERMAL/STRUCTURAL LOAD MODELLING **c07**
R. J. Maffeo *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 9 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

A serious problem exists interfacing the output temperatures and temperature gradients from either the heat transfer codes or engine tests with the input to stress analysis codes. A thermal load transfer code was developed and was used in conjunction with a three-dimensional model of a combustor liner for verification. The 3D heat transfer and stress analysis models of combustor liners and turbine blades were used to validate the mapped temperature produced by the transfer module. Verification cases were made for both finite element and finite difference heat transfer codes. A user manual for the code was written and is available. B.G.

N87-11206*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
THE 3D INELASTIC ANALYSIS METHODS FOR HOT SECTION COMPONENTS **c34**
M. L. Roberts, R. L. McKnight, L. T. Dame, and P. C. Chen *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 3 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

Advanced 3-D inelastic structural/stress analysis methods and solution strategies for more accurate and yet more cost-effective analysis of combustors, turbine blades, and vanes are being developed. The approach is to develop four different theories, one linear and three higher order with increasing complexities including embedded singularities. Progress in each area is reported. B.G.

N87-11207*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
COMPONENT SPECIFIC MODELING **c07**
M. L. Roberts *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 21E

Modern jet engine design imposes extremely high loadings and temperatures on hot section components. A series of interdisciplinary modeling and analysis techniques which were specialized to address three specific components (combustor burner linings, hollow air-cooled turbine blades, and air-cooled turbine vanes) were developed and verified. These techniques will incorporate data as well as theoretical methods from many diverse areas, including cycle and performance analysis, heat transfer analysis, linear and nonlinear stress analysis, and mission analysis. Building on the proven techniques already available in these fields, the new methods developed will be integrated to predict temperature, deformation, stress, and strain histories throughout a complete flight mission. B.G.

N87-11208*# Pratt and Whitney Aircraft, East Hartford, Conn.
THE 3-D INELASTIC ANALYSIS METHODS FOR HOT SECTION COMPONENTS (BASE PROGRAM)
E. S. Todd *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

A series of computer codes are sought that would permit more accurate and efficient three-dimensional inelastic structural analysis of combustor liners, turbine blades, and turbine vanes. Each code embodies a progression of mathematical models for increasingly comprehensive representation of the geometrical features, loading conditions, and forms of nonlinear material response that distinguish these three groups of hot section components. B.G.

N87-11209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE STRESS-STRAIN ANALYSIS
Robert L. Thompson *In its* Turbine Engine Hot Section Technology, 1984 Oct. 1984 14 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

The objectives are threefold: to assist in developing predictive tools needed to improve design analyses and procedures for the efficient and accurate prediction of burner liner structural performance and response; to calibrate, validate, and evaluate these predictive tools by comparing the predicted results with the experimental data; and to evaluate existing as well as advanced temperature and strain measurement instrumentation, through both contact and noncontact efforts, in a simulated turbine engine combustor environment. As the predictive tool, tests, test methods, instrumentation, and data acquisition and reduction methods are developed and evaluated, a proven, integrated analysis/experiment method will be developed that will permit the accurate prediction of the cyclic life of a burner liner. Author

N87-11210*# Akron Univ., Ohio.
HIGH-TEMPERATURE CONSTITUTIVE MODELING
D. N. Robinson and J. R. Ellis *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 11 p (For primary document see N87-11180 02-39)
(Grant NAG3-379)
Avail: NTIS HC A17/MF A01 CSCL 20K

Thermomechanical service conditions for high-temperature levels, thermal transients, and mechanical loads severe enough to cause measurable inelastic deformation are studied. Structural analysis in support of the design of high-temperature components depends strongly on accurate mathematical representations of the nonlinear, hereditary, inelastic behavior of structural alloys at high temperature, particularly in the relatively small strain range. Progress is discussed in the following areas: multiaxial experimentation to provide a basis for high-temperature multiaxial constitutive relationships; nonisothermal testing and theoretical development toward a complete thermomechanically path dependent formulation of viscoplasticity; and development of viscoplastic constitutive model accounting for initial anisotropy. B.G.

N87-11211*# Southwest Research Inst., San Antonio, Tex.
CONSTITUTIVE MODELING FOR ISOTROPIC MATERIALS

Ulric S. Lindholm *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

A state-of-the-art review of applicable constitutive models with selection of two for detailed comparison with a wide range of experimental tests was conducted. The experimental matrix contained uniaxial and biaxial tensile, creep, stress relaxation, and cyclic fatigue tests at temperatures to 1093 C and strain rates from .0000001 to .001/sec. Some nonisothermal cycles will also be run. The constitutive models will be incorporated into the MARC finite element structural analysis program with a demonstration computation made for advanced turbine blade configuration. In the code development work, particular emphasis is being placed on developing efficient integration algorithms for the highly nonlinear and stiff constitutive equations. Another area of emphasis is the appropriate and efficient methodology for determing constitutive constants from a minimum extent of experimental data. Author

N87-11212*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
CONSTITUTIVE MODELING FOR ISOTROPIC MATERIALS
V. G. Ramaswamy, R. H. VanStone, L. T. Dame, and J. H. Laflen *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 12 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

The unified constitutive theories for application to typical isotropic cast nickel base supperalloys used for air-cooled turbine blades were evaluated. The specific modeling aspects evaluated were: uniaxial, monotonic, cyclic, creep, relaxation, multiaxial, notch, and thermomechanical behavior. Further development of the constitutive theories to model thermal history effects, refinement of the material test procedures, evaluation of coating effects, and verification of the models in an alternate material will be accomplished in a follow-on for this base program. Author

N87-11213*# Pratt and Whitney Aircraft, East Hartford, Conn.
CREEP FATIGUE LIFE PREDICTION FOR ENGINE HOT SECTION MATERIALS (ISOTROPIC): TWO YEAR UPDATE c38
Vito Moreno *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
(Contract NAS3-23288)
Avail: NTIS HC A17/MF A01 CSCL 14D

Requirements for increased durability of gas turbine hot section components have placed a greater degree of importance on accurate structural analysis and life prediction. Various life prediction approaches for high temperature applications were investigated. Basic models were selected and developed for simple-cycle, isothermal loading conditions. Models will be developed which address thermomechanical cycling, multiaxial conditions, cumulative loading, environmental effects, and cyclic mean stress. Verification tests of models will be conducted on an alternate material and coating system. B.G.

N87-11214*# General Electric Co., Fairfield, Conn. Aircraft Engine Business Group.
ELEVATED TEMPERATURE CRACK GROWTH
K. S. Kim, J. F. Yau, R. H. VanStone, and J. H. Laflen *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

Critical gas turbine engine hot section components such as blades, vanes, and combustor liners tend to develop minute cracks during early stages of operations. The ability of currently available path-independent (P-I) integrals to correlate fatigue crack propagation under conditions that simulate the turbojet engine combustor liner environment was determined. To date, an appropriate specimen design and a crack displacement measurement method were determined. Alloy 718 was selected as the analog material based on its ability to simulate high temperature behavior at lower temperatures in order to facilitate experimental measurements. Available P-I integrals were reviewed and the best approaches are being programmed into a finite element post processor for eventual comparison with experimental data. The experimental data will include cyclic crack growth tests under thermomechanical conditions, and, additionally, thermal gradients. B.G.

N87-11215*# Syracuse Univ., N. Y. Dept. of Mechanical Engineering.
OXIDATION AND LOW CYCLE FATIGUE LIFE PREDICTION c38
Yoshiki Oshida and Hao-Wen Liu *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 9 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 11D

When a metallic material is exposed to a high temperature in an ambient atmosphere, oxidation takes place on the metallic surface. The formed oxides (both surface and grain boundary oxides) are mechanically brittle so that if the stress is high enough the oxides will be cracked. The grain boundary oxide formation in TAZ-8A nickel-base superalloy was studied. The effect of oxide crack nucleus on low cycle fatigue life will be analyzed. The TAZ-8A was subjected to high temperature oxidation tests in air under the stress-free condition. The oxidation temperatures were 600, 800, and 1000 C. The oxidation time varies from 10 to 1000 hours. B.G.

N87-11216*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Engineering Mechanics.
CONSTITUTIVE MODELING OF INELASTIC ANISOTROPIC MATERIAL RESPONSE
D. C. Stouffer *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 4 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

A constitutive equation was developed to predict the inelastic thermomechanical response of single crystal turbine blades. These equations are essential for developing accurate finite element models of hot section components and contribute significantly to the understanding and prediction of crack initiation and propagation. The method used was limited to unified state variable constitutive equations. Two approaches to developing an anisotropic constitutive equation were reviewed. One approach was to apply the Stouffer-Bodner representation for deformation induced anisotropy to materials with an initial anisotropy such as single crystals. The second approach was to determine the global inelastic strain rate from the contribution of the slip in each of the possible crystallographic slip systems. A three dimensional finite element is being developed with a variable constitutive equation link that can be used for constitutive equation development and to predict the response of an experiment using the actual specimen geometry and loading conditions. B.G.

N87-11217*# Connecticut Univ., Storrs.
BIAXIAL CONSTITUTIVE EQUATION DEVELOPMENT
Eric H. Jordan and Kevin P. Walker *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 7 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20K

In developing the constitutive equations an interdisciplinary approach is being pursued. Specifically, both metallurgical and continuum mechanics considerations are recognized in the formulation. Experiments will be utilized to both explore general qualitative features of the material behavior that needs to be modeled and to provide a means of assessing the validity of the equations being developed. The model under development explicitly recognizes crystallographic slip on the individual slip systems. This makes possible direct representation of specific slip system phenomena. The present constitutive formulation takes the anisotropic creep theory and incorporates two state variables into the model to account for the effect of prior inelastic deformation

history on the current rate-dependent response of the material.
B.G.

N87-11218*# Pratt and Whitney Aircraft, East Hartford, Conn.
LIFE PREDICTION AND CONSTITUTIVE MODELS FOR ENGINE HOT SECTION ANISOTROPIC MATERIALS **c38**
Gustav A. Swanson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 14D

The development of directionally solidified and single crystal alloys is perhaps the most important recent advancement in hot section materials technology. The objective is to develop knowledge that enables the designer to improve anisotropic gas turbine parts to their full potential. Two single crystal alloys selected were PWA 1480 and Alloy 185. The coatings selected were an overlay coating, PWA 286, and an aluminide diffusion coating, PWA 273. The constitutive specimens were solid and cylindrical; the fatigue specimens were hollow and cylindrical. Two thicknesses of substrate are utilized. Specimens of both thickness (0.4 and 1.5 mm) will be coated and then tested for tensile, creep, and fatigue properties. B.G.

N87-11219*# General Motors Corp., Detroit, Mich. Gas Turbine Div.
TURBINE AIRFOIL GAS SIDE HEAT TRANSFER **c34**
Edward R. Turner *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 14 p (For primary document see N87-11180 02-39)
(Contract NAS3-23695)
Avail: NTIS HC A17/MF A01 CSCL 20D

Work is currently underway to develop and characterize an analytical approach, based on boundary layer theory, for predicting the effects of leading edge (showerhead) film cooling on downstream gas side heat transfer rates. Parallel to this work, experiments are being conducted to build a relevant data base for present and future methods verification. Author

N87-11220*# Scientific Research Associates, Inc., Glastonbury, Conn.
CALCULATION OF TWO- AND THREE-DIMENSIONAL TRANSONIC CASCADE FLOW FIELD USING THE NAVIER-STOKES EQUATIONS **c34**
B. C. Weinberg, R.-J. Yang, S. J. Shamroth, and H. McDonald *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
(Contract NAS3-23695)
Avail: NTIS HC A17/MF A01 CSCL 20D

A Navier-Stokes analysis employing the time-dependent Linearized Block Implicit scheme (LBI) was applied to two-dimensional and three-dimensional transonic turbulent cascade flows. In general, the geometrical configuration of the turbine blade impacts both the grid construction procedure and the implementation of the numerical algorithm. Since modern turbine blades of interest are characterized by very blunt leading edges, rounded trailing edges and high stacking angles, a robust grid construction procedure is required that can accomodate the severe body shape while resolving regions of large flow gradients. A constructive O-type grid generation technique, suitable for cascades with rounded trailing edges, was developed and used to construct the C3X turbine cascade coordinate grid. Two-dimensional calculations were performed employing the Navier-Stokes procedure for the C3X turbine cascade, and the predicted pressure coefficients and heat transfer rates were compared with the experimental data. Three-dimensional Navier-Stokes calculations were also performed. B.G.

N87-11221*# United Technologies Research Center, East Hartford, Conn.
MEASUREMENT OF AIRFOIL HEAT TRANSFER COEFFICIENTS ON A TURBINE STAGE **c34**
Robert P. Dring and Michael F. Blair *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

The primary basis for heat transfer analysis of turbine airfoils is experimental data obtained in linear cascades. A detailed set of heat transfer coefficients was obtained along the midspan of a stator and a rotor in a rotating turbine stage. The data are to be compared to standard analyses of blade boundary layer heat transfer. A detailed set of heat transfer coefficients was obtained along the midspan of a stator located in the wake of a full upstream turbine stage. Two levels of inlet turbulence (1 and 10 percent) were used. The analytical capability will be examined to improve prediction of the experimental data. B.G.

N87-11222*# Stanford Univ., Calif. Thermosciences Div.
EFFECTS OF VERY HIGH TURBULENCE ON CONVECTIVE HEAT TRANSFER **c34**
Robert J. Moffat and Paul K. Maciejewski *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 8 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

The effects of high-intensity, large-scale turbulence on turbulent boundary-layer heat transfer are studied. Flow fields were produced with turbulence intensities up to 40% and length scales up to several times the boundary layer thickness. In addition, three different types of turbulence will be compared to see whether they have the same effect on the boundary layer. The three are: the far field of a free jet, flow downstream of a grid, and flow downstream of a simulated gas turbine combustor. Each turbulence field will be characterized by several measures: intensity (by component), scale, and spectrum. Heat transfer will be measured on a 2.5 m long, 0.5 m wide flat plate using the energy-balance technique. The same plate will be used in each of the four flow fields; a low-turbulence tunnel for baseline data, and the three flow situations mentioned. B.G.

N87-11223*# Tennessee Univ. Space Inst., Tullahoma.
GAS FLOW ENVIRONMENTAL AND HEAT TRANSFER NON-ROTATING 3D PROGRAM **c34**
R. A. Crawford *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 5 p (For primary document see N87-11180 02-39)
(Contract NAS3-23278)
Avail: NTIS HC A17/MF A01 CSCL 20D

The experimental contract objective is to provide a complete set of benchmark quality data for the flow within a large rectangular turning duct. The data are to be used to evaluate and verify three-dimensional internal viscous flow models and computational codes. The analytical contract objective is to select such a computational code and define the capabilities of this code to predict the experimental results. Details of the proper code operation will be defined and improvements to the code modeling capabilities will be formulated. Author

N87-11224*# United Technologies Research Center, East Hartford, Conn.
ASSESSMENT OF A 3-D BOUNDARY LAYER CODE TO PREDICT HEAT TRANSFER AND FLOW LOSSES IN A TURBINE **c34**
Olof L. Anderson *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 6 p (For primary document see N87-11180 02-39)
(Contract NAS3-23716)
Avail: NTIS HC A17/MF A01 CSCL 20D

Zonal concepts are utilized to delineate regions of application of three-dimensional boundary layer (DBL) theory. The zonal approach requires three distinct analyses. A modified version of the 3-DBL code named TABLET is used to analyze the boundary layer flow. This modified code solves the finite difference form of the compressible 3-DBL equations in a nonorthogonal surface coordinate system which includes coriolis forces produced by coordinate rotation. These equations are solved using an efficient, implicit, fully coupled finite difference procedure. The nonorthogonal

surface coordinate system is calculated using a general analysis based on the transfinite mapping of Gordon which is valid for any arbitrary surface. Experimental data is used to determine the boundary layer edge conditions. The boundary layer edge conditions are determined by integrating the boundary layer edge equations, which are the Euler equations at the edge of the boundary layer, using the known experimental wall pressure distribution. Starting solutions along the inflow boundaries are estimated by solving the appropriate limiting form of the 3-DBL equations. B.G.

N87-11225*# Pratt and Whitney Aircraft, East Hartford, Conn.
COOLANT PASSAGE HEAT TRANSFER WITH ROTATION, A PROGRESS REPORT c34
F. C. Kopper *In* NASA. Lewis Research Center Turbine Engine Hot Section Technology, 1984 Oct. 1984 10 p (For primary document see N87-11180 02-39)
Avail: NTIS HC A17/MF A01 CSCL 20D

The objective of this 36-month experimental and analytical program is to develop a heat transfer and pressure drop database, computational fluid dynamic techniques, and correlations for multipass rotating coolant passages with and without flow turbulators. The experimental effort will be focused on the simulation of configurations and conditions expected in the blades of advanced aircraft high pressure turbines so that the effects of Coriolis and buoyancy forces on the coolant side flow can be rationally included in the design of turbine blades. Author

N87-11226# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
STOCHASTIC CRACK PROPAGATION WITH APPLICATIONS TO DURABILITY AND DAMAGE TOLERANCE ANALYSES Final Report, Jun. 1983 - Feb. 1985
J. N. Yang, W. H. Hsi, and S. D. Manning Sep. 1985 263 p
(Contract F33615-83-K-3226)
(AD-A168040; AFWAL-TR-85-3062) Avail: NTIS HC A12/MF A01 CSCL 20/11

Various stochastic models for fatigue crack propagation under either constant amplitude or spectrum loadings have been investigated. These models are based on the assumption that the crack growth rate is a lognormal random process, including the general lognormal random process, lognormal white noise process, lognormal random variable, and second moment approximations, such as Weibull, gamma, lognormal and Gaussian closure approximations. Extensive experimental data have been used for the correlation study with various stochastic models. These include fastener hole specimens under fighter or bomber spectrum loadings and center-cracked specimens under constant amplitude loads. The data sets for the fastener hole specimens cover adequately different loading conditions, environments, load transfers and crack size range. It is shown that the white noise process is definitely not a valid model for fatigue crack propagation. GRA

N87-11227# Denver Univ., Colo. College of Engineering.
MEASUREMENT OF STRESS DISTRIBUTIONS IN ADHESIVE BONDED JOINTS Final Report, 17 Aug. 1981 - 28 Feb. 1986
P. K. Predecki, C. S. Barrett, and A. B. Lankford 4 Apr. 1986 14 p
(Contract DAAG29-81-K-0150)
(AD-A169176; ARO-18358.4-MS) Avail: NTIS HC A02/MF A01 CSCL 20/11

Triaxial stresses were determined by X-ray diffraction in the Aluminum adherend of a single lap joint at an average depth of .033 mm from the Al/adhesive interface. Access to the joint was gained non-destructively by making one adherend of Be (relatively transparent to CuK alpha radiation) and the other of Al alloy (relatively opaque). The incident X-ray beam passed through the Beryllium and the adhesive (FM-73M, American Cyanamid Co.) and was diffracted from the Al adherend adjacent to the Al/adhesive interface. Changes in the lattice spacing of the (511) + (333) reflection of Al compared with the stress free spacing were used to determine the strain and stress tensors along the bond. Measurements were made in the as-cured and loaded conditions, and on specimens containing an intentional debond. Results for the loaded condition were compared with Texagap-2D finite element calculations for a nominally identical specimen at a depth .033 mm into the Al adherend. The comparison showed a general agreement in trends and magnitudes for all the stress components except at the extremities of the bond. In particular, the measured peel stress at one extremity was substantially larger than the calculated peel stress. The discrepancies between measured and calculated stresses can be explained qualitatively by the presence of an unintentional debond of depth less than 0.5 mm at the one extremity. GRA

N87-11228# Ames Lab., Iowa.
USING ACOUSTIC WAVES FOR THE CHARACTERIZATION OF CLOSED FATIGUE CRACKS
O. Buck, R. B. Thompson, and D. K. Rehbein 1986 26 p Presented at the International Symposium on Fatique Crack Closure, Charleston, S.C., 1 May 1986
(Contract W-7405-eng-82)
(DE86-011404; IS-M-585; CONF-8605141-1) Avail: NTIS HC A03/MF A01

Partial contact of two rough fatigue crack surfaces leads to transmission, reflection, diffraction and mode conversion of an acoustic signal at those contacts (asperities). This paper reviews recent experimental and theoretical efforts to understand such interactions and uses them to quantify contact on actual fatigue cracks in greater detail. It is shown that the size and density of individual contacts, or asperities, can be estimated from acoustic measurements. Furthermore, it is shown that this information is needed to calculate the static stress across a partially closed crack as well as the effective stress intensity range which activates fatigue crack propagation. DOE

N87-11229# Sandia National Labs., Albuquerque, N. Mex.
CURRENT PROBLEMS IN SOLID DYNAMICS
W. Herrmann 1986 15 p Presented at the 30th Anniversary Symposium of the Inst. of Mechanics, Beijing, China, 8 Jun. 1986
(Contract DE-AC04-76DP-00789)
(DE86-011653; SAND-86-1321C; CONF-8606137-1) Avail: NTIS HC A02/MF A01

Current and future problems are addressed in the field of solid dynamics, that is, the response of materials and structures to explosions, high velocity impacts and pulsed radiation. Since such responses usually involve large deformations and nonlinear material behavior, numerical solutions are used almost exclusively for engineering design and performance assessment. Limited potential is forseen for future development of finite difference or finite element methods, but the development of algorithms implementing them, with particular emphasis on data and logic flow on vector and parallel computer architectures, hold promise of large increases in potential efficiency and the capability to do more realistic computer modeling, particularly when algorithms and architectures are developed to work together. Exact analytic solutions to test problems to validate the numerical methods are needed. The question of stability and convergence of the numerical methods for nonlinear problems is very important, and this difficult area needs attention. Many constitutive equations describing nonlinear material behavior are of incremental and rate type, and admit various instabilities and bifurcations in initial-boundary value problems of engineering interest, such instabilities being commonly observed experimentally. Qualitative analysis of such behavior of the differential equations is very important to ensure that special numerical solutions are physically correct. DOE

N87-11230# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Anlagentechnik.
THE FINITE ELEMENT METHOD FOR CALCULATION OF THE CALIBRATION CURVES FOR FRACTURE MECHANICS SPECIMENS OF VARIOUS THICKNESS FOR THE ELECTRICAL DIRECT CURRENT POTENTIAL CRACK MONITORING SYSTEMS [FINITE-ELEMENT-ANALYSE ZUR ERMITTLUNG DER EICHKURVEN FUER BRUCHMECHANIKPROBEN VERSCHIEDENER DICKE FUER DIE MESSUNG DER TIEFE VON HALB-

KREISFOERMIGEN OBERFLAECHENRISSEN MIT DER ELEKTRISCHEN GLEICHSTROM-POTENTIAL-METHODE]
R. Dietrich and W. Schonfeld 1986 27 p In GERMAN; ENGLISH summary
(GKSS-86/E/3; ISSN-0344-9629; ETN-86-97827) Avail: NTIS HC A03/MF A01

The finite element method is utilized to calculate the calibration curves required for the electrical potential crack-monitoring systems as applied to fracture mechanics specimens with thickness of 5, 10, 15, 18 and 20 mm. The starting crack is a0 = 2 mm for all specimens. ESA

N87-11231# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
RELEVANCE OF SHORT FATIGUE CRACK GROWTH DATA FOR DURABILITY AND DAMAGE TOLERANCE ANALYSES OF AIRCRAFT
Anders F. Blom Mar. 1986 19 p Presented at Engineering Foundation Second International Conference on Small Fatigue Cracks, Santa Barbara, Calif., 5-10 Jan. 1986 Submitted for publication Sponsored by Swedish Board for Technical Development
(FFA-TN-1986-23; ETN-86-97857) Avail: NTIS HC A02/MF A01

Starting from damage tolerance requirements and proceeding over the experimental and numerical means to verify these requirements, it is concluded that the relevance of short fatigue crack studies is limited to durability of the airframe. For engines, the behavior of short cracks is crucial if a damage tolerant design is to be considered. It is suggested that any type of analysis involving short cracks has to be probabilistic. Such a technique is described. ESA

N87-11232# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Werkstofftechnologie.
IDENTIFICATION OF CREEP MECHANISMS AND QUANTITATIVE DESCRIPTION OF STRESS REGIMES RELEVANT TO DESIGN
Heinz Lahodny, Krystyna Spiradek, and Hans Peter Degischer Mar. 1986 17 p Presented at COST-50 and COST-501 Session on High Temperature Alloys for Gas Turbines and Other Applications, Liege, Belgium, 6-9 Oct. 1986
(OEFZS-4352; WE-389/86; ETN-86-97880) Avail: NTIS HC A02/MF A01

Results of constant load creep tests on different heats of wrought alloy 800H were used to develop a method to identify and quantify steady state creep stages. The creep behavior between 1073 and 1223K is described by steady state strain rate equations for epsilon dot sub n at prevailing dislocation mechanisms and for epsilon dot sub d attributed to diffusional creep. Their limits of validity are stated and the microstructural verification is presented. Creep stage maps and creep test procedures which supply the data for the prediction of the lower time limit to reach certain creep strains are suggested. ESA

N87-11233# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FATIGUE FRACTURE IN STEEL LANDING GEAR COMPONENTS
R. J. H. Wanhill 7 Jun. 1985 14 p Sponsored by the Royal Netherlands Air Force Scientific Research Division of the Directorate of Material
(NLR-MP-85050-U; B8668293; ETN-86-98492) Avail: NTIS HC A02/MF A01

The characteristics of fatigue and overload fracture in high strength low alloy steel landing gear forgings were investigated. Fatigue fracture was characterized by microserrated acicular ridges and to a lesser extent by striation marks. Overload fracture was by microvoid coalescence (dimples). After corrosion due to outdoor exposure it is possible to identify fatigue fracture, but overload dimples are much less evident. Constant amplitude and block program (flight-by-flight) fatigue crack propagation rates are well correlated by root mean values of the stress intensity factor range. This is encouraging for analytical estimation of service failure crack propagation lives. ESA

N87-11234 Ohio State Univ., Columbus.
EXTENSION OF THE RITZ METHOD TO THE FORCED, DAMPED VIBRATIONS OF ROTATING STRUCTURAL ELEMENTS Ph.D. Thesis
Tyau-Her Young 1986 186 p
Avail: Univ. Microfilms Order No. DA8612425

The Ritz method is used to analyze the free, undamped vibrations of structural elements such as plates and shells, but is seldom applied to solve forced, damped vibration problems. Therefore, an extension of the method is applied to this kind of problem in which the structural elements are either non-rotating or rotating. Two kinds of linear damping (viscous and material damping) are considered, and the forcing function which is either distributed or concentrated at a particular point varies sinusoidally with time. Numerical results are presented for cantilever rectangular plates and shallow shell elements of rectangular planform. The displacements are assumed as linear combinations of simple algebraic polynomials, which permit relatively easy integration and satisfy completely the geometric boundary conditions of the problems. It is found that the end concentrated excitation excites higher bending modes more than the uniformly distributed excitation; material damping damps out higher modes more effectively than viscous damping. Also, the effect of rotation stiffens the system, while the effects of sweep and setting angles not only make the system more flexible but also complicate the response shape. Moreover, unlike in the free, undamped vibration problems, convergence of displacements is not monotonic and is not as good as that of natural frequencies. Dissert. Abstr.

N87-10893# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Mechanical Systems Div.
ESA FRACTURE CONTROL POLICY AND FRACTURE MECHANICS SPECTRA FOR STS PAYLOADS
G. G. Reibaldi, A. A. tenHave, A. U. deKoning, and J. Ph. vanHerwaarden (Royal Netherlands Aircraft Factories Fokker, Amsterdam) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 51-55 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10896# Texas Univ., Austin.
A STUDY OF NODAL COUPLING METHODS
R. R. Craig *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 75-80 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10897# Intespace, Toulouse (France).
EFFECTIVE MODAL PARAMETERS AND TRUNCATION EFFECTS IN STRUCTURAL DYNAMICS [PARAMETRES MODAUX EFFECTIFS ET EFFETS DE TRONCATURE EN DYNAMIQUE DES STRUCTURES]
A. Girard and J. F. Imbert *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 81-86 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10899# Cisigraph, Rungis (France).
FLUID-STRUCTURE INTERACTION: MODAL SYNTHESIS METHOD [INTERACTION FLUIDE STRUCTURE: METHODE DE SYNTHESE MODALE]
R. Savouillan, F. Besnier, and G. Rozenblum *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 93-99 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10901# Rome Univ. (Italy).
COMPUTATIONAL METHODS IN ELASTIC PERIODIC STRUCTURES ANALYSES
Filippo Graziani and Silvano Sgubini *In* ESA Proceedings of an

International Conference on Spacecraft Structures Apr. 1986 p 109-112 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10904# London Univ. (England). Queen Mary Coll.
THE EFFECT OF THE NON-UNIFORM STRESS DISTRIBUTION IN THE BLANKETS OF SINGLE AND TWIN BOOM SOLAR ARRAY PANELS UPON THEIR MODAL CHARACTERISTICS
J. R. Wright *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 125-130 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10906# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PREDICTION OF THE HIGH FREQUENCY RESPONSE OF SATELLITES TO DIFFUSE ACOUSTIC ENVIRONMENTS
B. Troclet, T. DangTrong, and C. Vidal *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 145-150 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10907# Centre National d'Etudes Spatiales, Toulouse (France).
PREDICTION AND CORRELATION OF STRUCTURAL RESPONSE IN ACOUSTIC CHAMBERS [PREVISION ET CORRELATION DE LA REPONSE DE STRUCTURES EN CHAMBRE ACOUSTIQUE]
F. Mercier and H. Defosse *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 151-156 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10908# Centre National d'Etudes Spatiales, Paris (France). Direction des Lanceurs.
LOW FREQUENCY RESPONSE OF AXISYMMETRIC STRUCTURES TO RANDOM NOISE [REPONSES BASEES DE STRUCTURES AXISYMMETRIQUES EN BRUIT DIFFUS]
G. Borello *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 157-162 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10909# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACOUSTIC RADIATION AND INTERNAL DISSIPATION IN HONEYCOMB PANELS
K. T. Brown *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 163-168 Sponsored by British Aerospace, Filton, England (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10910# Technische Hochschule, Aachen (West Germany). Inst. fuer Leichtbau.
TRANSIENT EXTERNAL LOADS OR INTERFACE FORCES RECONSTRUCTED FROM STRUCTURAL RESPONSE MEASUREMENTS
H. Oery, H. Glaser, and D. Holzdeppe *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 171-177 Sponsored by Deutsche Forschungsgemeinschaft and MBB GmbH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10911# Kassel Univ. (West Germany).
STRUCTURAL SYSTEM IDENTIFICATION USING SINGLE AND MULTIAXIAL VIBRATION TEST DATA
M. Link *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 179-184 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10912# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec).
DEMONSTRATION OF MODAL SYNTHESIS ON AN EXPERIMENTAL STRUCTURE AND ITS APPLICATION TO LARGE SPACECRAFT
F. Charron, V. L. Jha, H. Lapierre, S. J. Sorocky, and F. R. Vigneron (Department of Communications, Ottawa, Ontario) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 185-190 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10913# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ANALYSIS/TEST CORRELATION AND UPDATE OF DYNAMIC MATHEMATICAL MODELS
Bernd Caesar *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 191-193 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10914# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. of Aeroelasticity.
APPLYING MODAL SURVEY TEST RESULTS FOR UPDATING DYNAMIC MATHEMATICAL MODELS OF SPACECRAFT STRUCTURES
H. Hueners *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 195-201 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10915# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
A REVIEW OF TIME DOMAIN MODAL TEST METHODS AND APPLICATIONS
Samir R. Ibrahim *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 205-211 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10926# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOADS ANALYSIS FOR THE GALILEO SPACECRAFT
Marc Trubert *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 293-298 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10930# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mathematics.
CRITICAL ELEMENT CONCEPTS FOR COMPOSITE STRUCTURES
Kenneth L. Reifsnider *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 323-328 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10938# Societe Bertin et Cie, Plaisir (France).
DYNAMICS OF FLEXIBLE MECHANISMS [DYNAMIQUE DE MECANISMES FLEXIBLES]
G. Gallay, F. Girard, and J. M. Auclair *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 381-386 In FRENCH (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10939# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Group.
ANALYTICAL PREDICTION OF CYLINDRICAL AND CASSINI-SHAPED SHELL CONTOURS AFTER PLASTIC STRETCHING
D. Hummel, J. Franz, and E. D. Sach *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 387-391 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
OPTIMIZATION OF AXIALLY COMPRESSED CFRP CYLINDERS
R. Zimmermann *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 407-412 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-10943# British Aircraft Corp., Filton (England).
SPACECRAFT STRUCTURAL ACOUSTICS: PROGRESS IN VIBRATION LEVEL PREDICTION
P. J. Williams, R. J. Cummins, and D. C. G. Eaton (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 415-428 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N87-11235 Centrum voor Landbouwpublikaties en Landbouwdocumentatie, Wageningen (Netherlands).
REMOTE SENSING METHODS TO DETERMINE THE VITALITY OF VEGETATION
B. vandeLustgraaf 1984 61 p In DUTCH; ENGLISH summary (Literatuuroverzicht-42; ISBN-90-220-0866-5; ETN-86-98073) Copyright. Avail: Issuing Activity

Technical and methodical details of remote sensing to assess damage to vegetation, particularly due to air pollution, are reviewed. Experiments show that remote sensing is as reliable as traditional methods based on field survey. However, field observation remains necessary since the causal agent usually cannot be identified from the remote sensing image. Large scale stereophotos using IR films give a reliable indication of vegetation vitality. Visual and photometric methods support the photoanalysis. Image enhancement techniques show good performance. Spectroradiometry is promising. Multispectral scanners on aircraft of satellites cannot yet compete with photographic techniques. Photographic remote sensing methods are cheaper than field based methods. ESA

N87-11236*# Utah Univ., Salt Lake City. Center for Remote Sensing and Cartography.
FOLLOW-ON PROPOSAL IDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS
Phillip M. Wright and Merrill K. Ridd 1986 26 p
(Grant NAGW-95)
(NASA-CR-179703; NAS 1.26:179703) Avail: NTIS HC A03/MF A01 CSCL 08B

Urban morphology (an examination of spatial fabric and structure), natural ecosystem (investigations emphasizing biophysical processes and patterns), and human ecosystem (emphasizing socio-economic and engineering parameters) were studied. The most critical variable, transpiration, in the ASPCON model, created by Jaynes (1978), describing the hydrology of aspen to conifer succession was studied to improve the accuracy. Transpiration is determined by a canopy transpiration model which estimates consumptive water use (CWU) for specific species and a plant activity index. Also studied was Pinyon-Juniper woodland erosion. B.G.

N87-11237*# California Univ., Santa Barbara. Dept. of Geography.
CANOPY REFLECTANCE MODELING IN A TROPICAL WOODED GRASSLAND Annual Report
David Simonett and Janet Franklin 15 Sep. 1986 57 p
(Grant NAGw-788)
(NASA-CR-179895; NAS 1.26:179895) Avail: NTIS HC A04/MF A01 CSCL 02F

Geometric/optical canopy reflectance modeling and spatial/spectral pattern recognition are used to study the form and structure of savanna in West Africa. An invertible plant canopy reflectance model is tested for its ability to estimate the amount of woody vegetation cover in areas of sparsely wooded grassland from remotely sensed data. Dry woodlands and wooded grasslands, commonly referred to as savannas, are important ecologically and economically in Africa, and cover approximately forty percent of the continent by some estimates. The Sahelian and Sudanian savanna make up the important and sensitive transition zone between the tropical forests and the arid Saharan region. The depletion of woody cover, used for fodder and fuel in these regions, has become a very severe problem for the people living there. LANDSAT Thematic Mapper (TM) data is used to stratify woodland and wooded grassland into areas of relatively homogeneous canopy cover, and then by applying an invertible forest canopy reflectance model to estimate directly the height and spacing of the trees in the stands. Since height and spacing are proportional to biomass in some cases, a successful application of the segmentation/modeling techniques will allow direct estimation of woody biomass, as well as cover density, over significant areas of these valuable and sensitive ecosystems. Sahelian savanna sites in the Gourma area of Mali being used by the NASA/GIMMS project (Global Inventory Modeling and Monitoring System, at Goddard Space Flight Center), in conjunction with CIPEA/Mali (Centre International pour l'Elevage en Afrique) will be used for testing the canopy model. The model will also be tested in a Sudanian zone crop/woodland area in the Region of Segou, Mali. Author

N87-11238# European Space Agency, Paris (France).
PROCEEDINGS OF THE THIRD INTERNATIONAL COLLOQUIUM ON SPECTRAL SIGNATURES OF OBJECTS IN REMOTE SENSING
T. D. Guyenne, ed. Dec. 1985 591 p In ENGLISH and FRENCH Colloquium held in Les Arcs, France, 16-20 Dec. 1985
(ESA-SP-247; ISSN-079-6566; ETN-86-97563) Avail: NTIS HC A25/MF A01

The PROMESS and TOSCANE T remote sensing simulation campaigns; modeling in the microwave region and over land; modeling in the optical domain (visible and infrared); passive spectral methods; active spectral methods; sensor and data calibration; and spectral characterization of objects were discussed. For individual titles, see N87-11239 through N87-11334.

N87-11239# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
AN EXPERIMENTAL CAMPAIGN FOR THE DETERMINATION OF RADAR STRUCTURE OF THE OCEAN AT C BAND
E. Attema *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 3-10 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The determination of the directional wave spectrum and the surface wind field over the ocean, using the instruments of the ERS-1 satellite is discussed. This requires accurate knowledge of the radar signature of the ocean expressed by the radar cross section per unit area, sigma zero. The wave spectrum determination requires a suitable modulation transfer function, and an empirical model for sigma zero and its dependence on wind speed, wind

direction and incidence angle forms the basis for the wind retrieval algorithm. An international experimental campaign was conducted to validate the empirical models and determine model parameters. It is shown how instruments were deployed to ensure a coherent and reliable experimental data set. Instruments included airborne scatterometers, airborne synthetic aperture radar, tower-based scatterometers, wave buoys and meteorological instruments on board aircraft, a research ship, and a research platform. ESA

N87-11240# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
AIRBORNE AND TOWER-BASED SCATTEROMETRY DURING THE PROMESS AND TOSCANE-T CAMPAIGNS
E. Attema *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 11-15 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

During the PROMESS and TOSCANE-T campaigns, scatterometers were used from aircraft and a research platform to measure ocean backscattering as a function of wind speed and direction. The principle of operation of each scatterometer is described. Internal and external calibration procedures are discussed. Absolute accuracy within 1dB is achieved. Flight patterns are outlined and samples of output data are presented. ESA

N87-11241# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
THE PROMESS 84 AND TOSCANE-85 CAMPAIGNS IN-SITU MEASUREMENTS
R. Ezraty, P. Queffeulou, and M. Champagne *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 17-22 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

During the PROMESS and TOSCANE-T campaigns wind vector, temperature, and sea-state measurements were performed using a ship to relate C band scatterometer normalized radar cross sections to the surface wind. The ship disturbing effect is evaluated to overestimate by 12% the wind measurement when the ship route is upwind. The mean wind speed measurement accuracy is estimated to be 0.3 m/sec. The method can be used to assess wind measurement accuracy on buoys using a shipborne reference. During the TOSCANE-T campaign, a network of coastal masts, a meteorological buoy, and a sea-state measuring buoy were deployed. The data analysis reveals that the wind measurements on the buoy are underestimated by 2 to 3 m/sec when the significant wave height is comparable to the measurement height. Coastal measurements must be used with caution because of topographic effects which depend on the wind azimuth with respect to the coast; so a coastal site has also to be calibrated. ESA

N87-11242# Toulouse Univ. (France). Lab. d'Aerologie.
AIRBORNE MEASUREMENT METHODS APPLIED TO THE DETERMINATION OF BOUNDARY CONDITIONS AT THE SEA SURFACE: THE TOSCANE EXPERIMENT [METHODES DE MESURES AEROPORTEES APPLIQUEES A LA DETERMINATION DES CONDITIONS AUX LIMITES SUR LA MER: EXPERIENCE TOSCANE]
P. Durand, F. Said, and A. Druilhet *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 23-28 In FRENCH Sponsored by Inst. National d'Astronomie et de Geophysique (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Two light aircraft were used to collect data on average boundary layer conditions at the sea surface and on turbulent air flow over the sea. The method for calculating turbulent flow is presented. Advantages and disadvantages of the aircraft for this type of data collection are discussed, particularly problems related to perturbations of information on the absolute speed of the aircraft. Consequences for the calculation of wind parameters and motion transfer are outlined. A solution which allows the turbulent horizontal kinetic energy global vertical motion transfer to be reconstructed is given. The relation between parameters calculated at the average flight altitude of 50 m and the conditions at the real boundary layer is considered. ESA

N87-11243# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
TOWARDS A C-BAND RADAR SEA ECHO MODEL FOR THE ERS-1 SCATTEROMETER
A. E. Long *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 29-34 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Specification of a vertical polarization radar echo model, CMOD1, based on airborne circle-flight, and radar scattering cross section measurements from three C-band scatterometer systems to relate normalized surface scattering cross-sections to radar beam incidence angle, wind speed and direction is described. The analyzed circle flight records are used to suggest the model form and to find its parameters by least squares fitting methods. The CMOD1 Specification is expected to be used in design and performance assessment of the ERS-1 scatterometer. ESA

N87-11244# Toulouse Univ. (France). Lab. d'Aerologie.
DYNAMICS OF THE MARINE BOUNDARY LAYER. DETERMINATION OF BOUNDARY CONDITIONS [DYNAMIQUE DE LA COUCHE LIMITE MARINE. DETERMINATION DES CONDITIONS AUX LIMITES]
A. Druilhet, F. Said, and P. Durand *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 35-41 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The dynamics of the atmospheric boundary layer are analyzed in order to determine boundary conditions over the ocean surface. Flow, temperature, and evaporation analysis methods based on average profile measurements and those requiring the measurement of turbulent functions are distinguished. The latter can be used in aircraft campaigns. They make possible the study of the spatial homogeneity of the boundary conditions and thus the integration of scales, a problem specific to satellite-borne remote sensing. ESA

N87-11245# Centre National d'Etudes Spatiales, Toulouse (France).
IN-FLIGHT CALIBRATION DURING PROMESS CAMPAIGN
J. M. Lopez *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 43-47 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Standard radar targets (spherical, corner reflectors, cones, squares) were calibrated. Radar cross sections, and angular coverage are described. Flight tests are summarized. ESA

N87-11246# Technische Hogeschool, Delft (Netherlands). Dept. of Electrical Engineering.
ANALYSIS AND CALIBRATION OF THE DUTCH SCATTEROMETER MEASUREMENTS
P. Snoeij *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 49-51 Sponsored by Dept. of Science Policy, and Netherlands Remote Sensing Board (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The airborne Dutscat scatterometer took part in the ESA C-band scatterometer campaign. The instrument and the calibration of the system using an array of corner reflectors is discussed. The radar cross section per unit area is presented. ESA

N87-11247# Institut Francais du Petrole, Rueil-Malmaison.
SAR IMAGING OF THE SEA SURFACE DURING THE ESA C-BAND WIND SCATTEROMETER CAMPAIGN
P. Piau, C. Blanchet, and L. Gray (Canada Centre for Remote Sensing, Ottawa, Ontario) *In* ESA Proceedings of the Third

International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 53-57 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The SAR 580 was used during the PROMESS experiment study of wind and wave measurements on the sea surface with C-band radars as will be made by the Active Microwave Instrument (AMI) aboard ERS-1. The meteorological conditions encountered during the experiment allowed a study with a good range of wave heights (1 to 7 m) and wind speeds. The SAR 580 performed measurements with different azimuth angles in C and X-band simultaneously. The wave length and direction of long waves are determined with a good accuracy. The determination of the additive noise level which degrades the determination of the amplitude of the image spectrum is discussed. It is shown that this SAR is very sensitive to range-traveling waves, and much less to the azimuth-traveling ones. ESA

N87-11248# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
ILLUSTRATION OF WIND FIELD TIME AND SPACE STATISTICS DURING THE TOSCANE-T CAMPAIGN c47
R. Ezraty, P. Queffeulou, and M. Champagne *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 59-61 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Using selected periods of wind data collected during the TOSCANE-T campaign, the differences that may occur using different speed averaging times are illustrated. A comparison with Pierson's model results is presented in terms of standard deviation. From a simulation, it is shown that differences between 10 mn averages may reach up to 2.6 m/sec within a 1 hr period. Comparisons of speed measurements at different coastal locations show the same order of magnitude of variations although coastal topographic effects are present. ESA

N87-11249# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
SEA WIND FLUCTUATIONS ANALYSIS c47
L. Lavanant, P. Queffeulou, and R. Ezraty *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 63-66 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The joint analysis of mesoscale sea wind fluctuations, recorded at two close positions, is presented. This is used to evaluate the time scale and spatial dimensions of the fluctuations and to verify the Taylor hypothesis. The analysis indicates that care must be taken when comparing scatterometer to in-situ data during calibration and validation. ESA

N87-11250# Toulouse Univ. (France). Lab. d'Aerologie.
ANALYSIS OF AIRBORNE MEASUREMENTS OF THE MARINE BOUNDARY LAYER DURING THE TOSCANE EXPERIMENT [ANALYSE DES MESURES AEROPORTEES DANS LA COUCHE LIMITE MARINE AU COURS DE L'EXPERIENCE TOSCANE]
F. Said, P. Durand, B. Koehler, and A. Druilhet *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 67-71 In FRENCH Sponsored by Inst. National d'Astronomie et de Geophysique (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Determination of dynamic atmospheric parameters from the boundary layer above the ocean surface in order to analyze scatterometer data is described. Two aircraft measured friction velocity and wind in the marine boundary layer. Parameterization of data from an area 25 km by 40 km is described. The method used to investigate two dimensional fields is presented. The homogeneity of the field above the sea is illustrated using sea surface temperature data and thermodynamic variables. Surface heat flux, evaporation, and circulation are compared with the wind field, showing a strong correlation. ESA

N87-11251# Physics Lab. RVO-TNO, The Hague (Netherlands).
ANALYSIS OF THE ESA WIND SCATTEROMETER CAMPAIGN DATA
G. P. deLoor *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 73-76 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

All data of the ESA wind scatterometer campaign as provided by the Central Data Library were analyzed. The data obtained fit the available empirical model and the parameters of this model were determined. The data set was related to the measured wind speed at 19.5 m and to the neutral stability wind. They are also compared with other data sets. ESA

N87-11252# Canada Centre for Remote Sensing, Ottawa (Ontario).
THE C AND Ku BAND SCATTEROMETER RESULTS FROM CANADIAN PARTICIPATION IN THE ESA PROMESS OCEAN MEASUREMENT CAMPAIGN
A. L. Gray and R. K. Hawkins *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 77-82 Sponsored by ESA and Innotech Aviation (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Multipolarized C and Ku-band fanbeam scatterometer and X(VV) and C(VV) SAR data were collected by aircraft during the ESA PROMESS ocean backscatter experiment. The C(VV) and Ku(HH) scatterometer data for incidence angles from 10 to 58 deg for straight flight lines and from 15 to 55 deg for circle flights is described. For light to moderate winds it is shown that there are significantly larger changes in Ku backscatter than at C band for the same change in wind speed. For the more important moderate to high speed wind regime however, the advantage Ku-band data has over C-band decreases and, on the basis of backscatter sensitivity, satisfactory performance can be expected from the ERS-AMI wind scatterometer. Results for C(VV) and Ku(HH) indicate that both frequencies respond in approximately the same way to a changing azimuth angle between the radar look and wind directions. ESA

N87-11253# Centre National de la Recherche Scientifique, Strasbourg (France). Groupement Scientifique de Teledetection Spatiale.
DETERMINATION OF LAND SURFACE PARAMETERS BY SATELLITE AND ASSOCIATED INVERSE PROBLEMS [DETERMINATION DES PARAMETERES SOL DE SURFACE A PARTIR DES SATELLITES ET LES PROBLEMES INVERSES ASSOCIES]
F. Becker and M. Raffy *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 85-92 In FRENCH; ENGLISH summary (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Relationships between ground parameters and those derived from satellites are discussed. It is shown that it is not possible to preserve the models at all scales if all parameters are extended in the same way from local to spatial scales. In order to preserve the models, a definition of the parameters at satellite scale is suggested as the result of the inversion of the models of measure. The stability of these models and the pertinence of the proposed definitions are discussed. ESA

N87-11254# Texas Univ., Arlington.
BACKSCATTER MEASUREMENTS FROM SIMULATED VEGETATION STRUCTURES
A. J. Blanchard and A. K. Fung *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 93-98 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Microwave simulation experiments investigated the radar backscatter response to particular vegetation geometries. The vegetation model is constructed of 3/4 inch schedule 40 PVC

pipe, 3/8 inch wide metal hose clamps, and 1 foot square plywood supports. The rings represent the water laden nodes of the natural vegetation. The clamps were easily moved to different locations on the stalk and thereby simulate vegetation with different nodal spacing. The results indicate that simulated targets offer a variety of experimental advantages when attempting to address the understanding of basic interaction phenomena. The simulation allows independent control of both target and system parameters that have an impact on the understanding process. Targets can be tailored to the theoretical model investigated. ESA

N87-11255# Bern Univ. (Switzerland).
MICROWAVE MODELING OF SNOW AND SOIL
E. Schanda *In* ESA of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 99-110 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Microwave scattering and emission of snow and soil with locally and temporally varying parameters, such as moisture content, surface roughness and subsurface structure, is determined by absorption, surface scattering, and volume scattering. Developments in modeling of microwave scatter, and emission properties of snow and soil are summarized. ESA

N87-11256# National Aerospace Lab., Amsterdam (Netherlands).
SIMULATION OF MULTITEMPORAL SAR IMAGES c32
G. J. L. Nooren *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 111-116 (For primary document see N87-11238 02-43)
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A25/MF A01

A method to convert multitemporal real aperture images into SAR-like imagery by modifying side-looking airborne radar imagery through the introduction of more speckle is described. Such imagery was used in experiments in segmentation and classification. The experiments show that while single frequency monotemporal radar data are hardly adequate for these tasks, multitemporal images are useful. ESA

N87-11257# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE EFFECT OF ELECTROMAGNETIC WAVE POLARIZATION ON WAVE ATTENUATION IN A VEGETATION CANOPY [EFFET DE LA POLARISATION D'UNE ONDE ELECTROMAGNETIQUE DANS L'ATTENUATION DE L'ONDE DANS UN COUVERT VEGETAL] c32
A. Lopes and T. Le-Toan *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 117-122 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The extinction coefficient of a radar wave traversing vegetation was modeled as a function of polarization and angle of incidence, using data from scatterometers and laboratory experiments. Results show that HH polarized waves suffer less attenuation than VV, and are more suitable for moisture determination of agricultural soils. Vegetation influence is minimal to 20 degrees of incidence in HH mode, while it is significant in VV. Penetration is greater with HH polarization, so that backscattering is influenced down to soil level. For VV polarization, the upper layer contributes most, so this type of polarization is better to study crops such as wheat, where the ears are of interest. ESA

N87-11258# Universite Catholique de Louvain (Belgium). Lab. de Telecommunications et d'Hyperfrequences.
A TRANSLATION PROPERTY IN ROUGH SURFACE SCATTERING c32
A. Guissard *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 123-125 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A translation property is established for the surface face field at any point of an arbitrary surface and applied to the determination of the far zone field scattered by a random rough surface. It is illustrated by the evaluation of the coherent scattered field and of the effective Fresnel reflection coefficients. It is shown that the coherent field scattered by a rough surface is always specular. This property could significantly simplify scattering calculations from arbitrary rough surfaces. ESA

N87-11259# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
EXPERIMENTS ON MODELING RADAR BACKSCATTER OF FOREST STANDS AND RESEARCH ON CLASSIFICATION c32
D. H. Hoekman *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 127-132 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Radar signatures of forest stands were measured at L and C-band with an airborne multiband scatterometer. Comparison of results with X-band data of the same site shows that radar backscatter levels of coniferous trees increase with increasing wavelength with respect to deciduous trees. At C-band the levels compare. Directional variations of the radar return of two forest stands were investigated. An experiment with big corner reflectors on the forest floor studied the attenuating properties of the forest canopy. At X-band, crowns of deciduous and coniferous trees show high attenuation factors. The attenuation of the canopy as a whole seems to be dominated by canopy architecture and aspect of measurement. Detection probabilities as a function of corner-background ratio are given. ESA

N87-11260# Texas Univ., Arlington. Wave Scattering Research Center.
SPACEBORNE SAR DEPOLARISATION AMBIGUITIES c32
A. J. Blanchard and D. Lukert *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 133-136 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The effect of radar system artifacts on the quality of measured cross polarization was studied for systems which utilize Doppler processing, specifically SAR. Results show that the same conditions regarding antenna polarization are required to recover high quality depolarization data for the SAR system, as the stationary system. There must be sufficient isolation between polarization channels to keep the like polarized scatter from feed into the cross polarized channel. There are additional requirements placed on aliased effects to reduce the effect of like polarized feedthrough into the aliased pulse. Since this effect is transformed to an azimuth position not associated with the resolution cell under consideration, it is more difficult to associate this effect with scattering processes attributed to that cell. ESA

N87-11261# Centre National d'Etudes Spatiales, Toulouse (France).
WIND TUNNEL INVESTIGATION OF THE CHARACTERIZATION OF RADAR BACKSCATTERING BY DIFFERENT WAVE FIELDS [ETUDE EN SOUFFLERIE DE LA CARACTERISATION DE LA RETRODIFFUSION RADAR PAR DIFFERENTS CHAMPS EN VOGUE] c32
A. Liefermann, A. Ramamonjiarisoa, and B. Jahne (Heidelberg Univ., West Germany) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 137-140 In FRENCH Sponsored by CNES, GRGS, and Inst. Francais de la Recherche pour l'Exploitation de la Mer (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The motion phases of waves and sea swell that contribute to C and K-band reflection of radar waves were investigated in a wind tunnel designed to simulate air-sea interactions. Results at vertical incidence for various swells, water waves, winds, and combinations of wind and swell are presented. A very important

contribution of wave breaking to radar backscattering strength is noted. ESA

N87-11262# National Aerospace Lab., Amsterdam (Netherlands).
A SCENE RADIATION MODEL BASED ON FOUR-STREAM RADIATIVE TRANSFER THEORY
W. Verhoef *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 143-150 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

An analytical four-stream radiative transfer model based on Suits's differential equations is applied to the atmosphere-Earth system to investigate the effects of the atmosphere and the view angle on remotely sensed multispectral radiance data from vegetation canopies. This scene radiation model is composed of two atmospheric layers and one vegetation layer resting on a Lambertian soil, combined by the Adding method. Input data for the model are Elterman's data on atmospheric optical depths, Deirmendjian's phase functions for atmospheric haze, visibility, directions of the Sun and of observation, and canopy parameters of the SAIL vegetation reflectance model, such as leaf area index and the leaf angle distribution. ESA

N87-11263# Texas Univ., Arlington.
SCATTERING MODELS FOR CONIFEROUS AND DECIDUOUS VEGETATION
A. K. Fung and M. F. Chen *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 151-156 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A layer of vegetation is modeled as a layer of needle-shaped or disk-shaped leaves. The scattering properties of both layer types are investigated with and without the presence of an irregular ground interface. The backscattering coefficients as a function of the incidence angle, frequency, polarization, leaf moisture, leaf angular distribution, and leaf size are illustrated. The ground surface roughness and ground moisture effects on the backscattering coefficient are shown to be important at small angles of incidence and remain significant at large angles of incidence for horizontal polarization. ESA

N87-11264# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELISATION OF THE OPTICAL SCATTERING BEHAVIOUR OF THE VEGETATION CANOPIES
D. S. Kimes *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 157-163 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The three dimensional model of Kimes (1984) which can treat three dimensional variability in heterogeneous scenes, was used to test and expand physical scattering mechanisms involved in reflectance distribution dynamics by analyzing modeling and field data. The major physical phenomena causing the directional scattering behavior of vegetation canopies are presented. These include the strong anisotropic properties of the soil, and the anisotropic scattering properties of the vegetation as described by the phase function of the leaves and the geometric effects caused by vertical layers of leaves. This knowledge serves as a basis for defining optimum directional view angles for remote sensing strategies. An example on using knowledge of the scattering behavior of vegetation to develop techniques for extracting vegetation parameters (spectral albedo) from directional reflectance data is presented. ESA

N87-11265# New York State Univ., Binghamton.
ESTIMATION OF CANOPY PARAMETERS FOR ROW-PLANTED VEGETATION CANOPIES FROM REFLECTANCE DATA THROUGH INVERSION OF CANOPY REFLECTANCE DATA
N. S. Goel and T. Grier *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 165-169 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A canopy reflectance (CR) model for row planted vegetation was tested for soybean canopies in three different stages of growth and for corn canopies in two stages of growth. The model fits the field measured bidirectional CR data quite well. It is shown that by inverting this model, the leaf area index and percent ground cover can be estimated quite accurately from measured canopy reflectances. ESA

N87-11266# Commissariat a l'Energie Atomique, Algiers (Algeria).
MODELING OF THE RELATION BETWEEN AIR TEMPERATURE AND SURFACE TEMPERATURE FOR THE SPATIAL EXTENSION OF SURFACE PARAMETER ANALYSIS MODELS [MODELISATION DE LA RELATION TEMPERATURE DE L'AIR/TEMPERATURE DE SURFACE EN VUE DE L'EXTENSION SPATIALE DES MODELES D'ANALYSE DES PARAMETRES DE SURFACE] c47
A. Abdellaoui *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 171-174 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A semiempirical model using measurements of average, minimum, and maximum temperatures was applied to in situ measurements of the air-surface interface. Results show that the daily dynamics of atmospheric temperature can be generated from the daily dynamics of surface temperature with an absolute maximum error of less than 3 deg. ESA

N87-11267# Centre National de la Recherche Scientifique, Montpellier (France). Lab. d'Ecophysiologie.
EFFECT OF ARCHITECTURAL PARAMETERS AND RADIATIVE CONDITIONS ON THE REMOTE SENSING OF THE LEAF INDEX OF VEGETATION CANOPIES [EFFET DES PARAMETRES ARCHITECTURAUX ET DES CONDITIONS RADIATIVES SUR LA TELEDETECTION DE L'INDICE FOLIAIRE DE COUVERTS VEGETAUX]
J. Dauzat *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 175-178 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A probabilistic radiative transfer model was used to study factors affecting the reflectance of vegetation canopies. It is shown how a leaf area index, practically independent of leafiness and Sun elevation can be established with a three channel radiometer (SPOT satellite type). ESA

N87-11268# Arizona Univ., Tucson. Dept. of Soil and Water Science.
RECONSTRUCTION OF VEGETATION SPECTRA FROM SOIL PLANT CANOPIES
A. R. Huete *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 179-182 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A spectral reconstruction technique was utilized to invert soil-plant canopy reflectances into soil and vegetation component spectra. Canopy spectra were decomposed into abstract eigenspectra, representing unique canopy reflecting components. The eigenspectra were transformed into canopy constituent spectral signatures through a least-squares target testing procedure based on bare soil and full-green canopy endmember spectra. Soil-plant canopy mixtures with different soil backgrounds and plant densities were decomposed and vegetation spectra were successfully reconstructed. It is found that in addition to a unique vegetation component, there exists an interactive soil-plant composite component. ESA

N87-11269# Canada Centre for Remote Sensing, Ottawa (Ontario).
GEOMETRIC MODEL SIMULATIONS OF CONIFER CANOPY REFLECTANCE
F. Cavayas and P. M. Teillet *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 183-189 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A mathematical model to predict the spectral signature of forested terrain as a function of simple canopy parameters, solar illumination geometry, and topography was developed. Basic elements of the forest model are presented, together with simulation results for the reflective spectral bands of the Landsat Thematic Mapper. The model retains basic concepts of the model of Strahler and Li and is also based on the principal of composite spectral signatures. For certain cases of population density and solar zenith angle, the simulation results show very significant changes in pixel reflectance as a function of terrain slope and aspect. ESA

N87-11270# Centre National d'Etudes Spatiales, Toulouse (France). Lab. d'Etudes et Recherches en Teledetection Spati
INFLUENCE OF TOPOGRAPHY AND THE ATMOSPHERE ON RADIOMETRIC MEASUREMENTS IN MOUNTAINOUS REGIONS: TESTS OF A SIGNAL INVERSION MODEL ON LANDSAT THEMATIC MAPPER (TM) DATA [INFLUENCE DE LA TOPOGRAPHIE ET DE L'ATMOSPHERE SUR LES MESURES RADIOMETRIQUES EN REGION MONTAGNEUSE: TEST D'UN MODELE D'INVERSION DU SIGNAL SUR DES DONNEES TM]
C. Proy and C. Leprieur *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 191-197 In FRENCH; ENGLISH summary (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Superposition of a digital terrain model on a Landsat image of the Pyrenees mountains was used to study altitude and exposure effects on the radiometry of each pixel and to assess correction methods. The influence of direct illumination, diffuse anisotropic illumination, and local relief was studied. A method for estimating atmospheric functions from image data was derived. The estimates are used in an inversion model that successively integrates the corrections. ESA

N87-11271# Tel-Aviv Univ. (Israel).
REFLECTIVITY CONTRAST OF FORESTED SLOPES WITH SNOW-COVERED GROUND
J. Ottermann and K. Staenz (Zurich Univ. (Switzerland).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 199-203 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Explicit expressions for the bidirectional reflectivities of terrain with very bright soil and dark trees were developed. The trees are represented as nonreflecting vertical cylinders and quantitatively described by the protrusion parameter (the sum of the products diameter times height over a unit area). The bidirectional reflectivity of the surface is formulated in terms of the reflectivity of the soil plane, considering the obscuration by the dark trees of the direct solar beam and of the radiation pencils reflected from the soil plane. Contrast ratio between the Sun-facing slope and the back slope for forested areas with snow on the ground is analyzed. The results are presented as graphs showing the contrast ratio variability as a function of the illumination and viewing geometry. The effects of finite thickness of the vertical cylinders to the bidirectional reflectivity are also analyzed. ESA

N87-11272# Nottingham Univ. (England). Dept. of Geography.
THE PHYSICAL AND PHYSIOLOGICAL INTERPRETATION OF VEGETATION SPECTRAL SIGNATURES
M. D. Steven *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 205-208 Sponsored by UK Agriculture and Food Research Council (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The near-infrared to red spectral ratio is investigated as a measure of the determinants of primary productivity. Good relationships are found with light interception except when the concentration of chlorophyll varies in leaves. When there is a corresponding variation in efficiency, spectral indices may give a direct measure of productivity. However, chlorophyll varies with applied nitrogen without any effect on efficiency and the indices overpredict differences in productivity. With water stress, variations in efficiency occur without affecting the spectral response and the indices underpredict differences in productivity. Spectral vegetation indices may be used to measure potential productivity, and separate data on stresses are required to assess the limits to that potential. ESA

N87-11273# Institut National de la Recherche Agronomique, Paris (France). Station de Bioclimatologie.
DESCRIPTION OF CROP GEOMETRY, RESTRICTED TO PARTS VIEWED [DESCRIPTION DE LA GEOMETRIE D'UNE CULTURE AVEC RESTITUTION AUX PARTIES VUES]
P. Boissard *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 209-212 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A photogrammetric method for geometric description of the spatial arrangement of plant leaves, stems, and tops was developed. It is a nondestructive, instantaneous method (photography), well suited to heterogeneous canopies like young crops or row structures. The method is illustrated by an example of manual stereoplotting on a maize canopy using a 5 cm contour-interval; and a directional azimuth analysis of highest layer leaves of the same canopy. ESA

N87-11274# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMAGING SPECTROMETRY: PAST, PRESENT, FUTURE
M. J. Abrams and A. F. H. Goetz *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 215-218 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Imaging spectrometry for the remote sensing of the Earth from aircraft and satellites is discussed. Results with an aircraft instrument show that remote, direct identification of surface materials is possible. The airborne and spaceborne sensors can acquire images in 100 to 200 spectral bands. The next generation aircraft scanner (AVIRIS) is expected to be operational in 1987. Plans are underway for a Shuttle instrument (SISEX) to fly in 1991. ESA

N87-11275# Institute of Ocean Sciences, Sidney (British Columbia).
DEVELOPMENT OF AN IMAGING OPTICAL SPECTROMETER FOR OCEAN AND LAND REMOTE SENSING c35
J. F. R. Gower, G. A. Borstad, and A. B. Hollinger (Moniteq Ltd., Concord (Ontario).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 219-225 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

To meet the requirements of improved optical land and sea imaging, particularly ocean and coastal chlorophyll fluorescence mapping, an airborne imaging spectrometer called Fluorescence Line Imager was designed and constructed. Results give insights into optical imaging of water color patterns. Examples of the image and spectral data are given. Technical problems and advantages associated with this type of instrument design, and benefits and opportunities for putting such an instrument into space are discussed. ESA

N87-11276# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH-SPECTRAL RESOLUTION REMOTE SENSING INSTRUMENTS DEVELOPED AND UNDER DEVELOPMENT AT CNES
c35
P. Vermande *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 227-232 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The operating principles of a field spectroradiometer are outlined and spectral signatures obtained are shown. A spectro-imager potentially for use on board a satellite is presented. Spectral analysis is performed by interferometry. The capability for detecting low radiance levels is considerbly better than in the case of dispersive instruments and the nature of the output data more amenable to processing in a wide variety of ways. ESA

N87-11277# Canada Centre for Remote Sensing, Ottawa (Ontario).
NARROW-BAND MULTISPECTRAL IMAGERY OF THE VEGETATION RED REFLECTANCE EDGE FOR USE IN GEOBOTANICAL REMOTE SENSING
R. P. Gauthier and R. A. Neville *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 233-236 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The MEIS 2, an airborne pushbroom imager having high sensitivity and high spatial resolution, provided narrow band (3 nm) imagery over areas of geological interest in Canada. Six spectral passbands were selected at wavelengths in the spectral range 680 to 800 nm to resolve the vegetation red reflectance edge. The imagery obtained in these bands was processed to give spectral reflectances. Problems in geobotanical remote sensing to be solved are discussed. A linear model for producing imagery of parameters which characterize the red reflectance edge is introduced. ESA

N87-11278# Institut National de la Recherche Agronomique, Avignon (France).
UTILIZATION OF HIGH SPECTRAL RESOLUTION TO MONITOR THE EVOLUTION OF WHEAT CROPS [UTILISATION DE LA HAUTE RESOLUTION SPECTRALE POUR SUIVRE L'EVOLUTION DE COUVERTS DEBLE]
I. Champion, F. Baret, G. Guyot, and A. Podaire (Centre National d'Etudes Spatiales, Toulouse (France).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 237-240 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The evolution of the reflectance spectra of 16 plots of wheat (4 types sown at 4 different dates) was followed throughout a growth cycle by a high spectral resolution spectroradiometer (1024 bands between 468.5 and 1064 nm). Results show that utilization of narrow spectral bands provides more information than the traditional wide bands. The inflection point on the reflectance curve between 670 and 760 nm and the red dip between 580 and 660 nm provide information on the state of the leaf surfaces and the ratio of ground coverage. A 4 to 5 nm spectral resolution is adequate to reveal the phenomena studied. ESA

N87-11279# Ecole Nationale Superieure de Physique, Strasbourg (France). Groupe de Teledetection.
EMISSIVITY IN THE THERMAL INFRARED: CONDITIONS FOR MEASUREMENT BY BACKSCATTERING AND COMPARISON WITH A PASSIVE MEASUREMENT METHOD [EMISSIVITE DANS L'INFRAROUGE THERMIQUE: CONDITIONS D'UNE MESURE PAR RETRODIFFUSION ET COMPARAISON AVEC UNE METHODE DE MESURE PASSIVE]
F. Becker, F. Nerry, P. Ramanantsizehena, and M. P. Stoll *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 241-244 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Emissivity of bare soils in the spectral band from 8 to 14 nm obtained by backscattering and passive methods are compared. Differences are less than experimental uncertainty. Results using the box method confirm those of the scattering model used in reflectivity calculation. Active remote sensing determination of emissivity from measurements of bidirectional reflectivity in the backscattering direction implies the intervention of a shape factor characteristic of the area observed. Neglect of this factor can cause significant errors in emissivity. ESA

N87-11280# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
AIRBORNE MEASUREMENTS OF THE SPECTRAL REFLECTANCE OF FRESHWATER ICE
G. A. Leshkevich *In* ESA Procesdings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 245-248 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Spectral radiance from open water, old snow, and four freshwater ice types was measured over Saginaw Bay (Lake Huron) from an altitude of 300 m under clear skies. Simultaneous radiance and irradiance measurements were made at (or near) the surface over a reference panel and over the old snow and water. Three measurements were made over each surface type and averaged. After determining the spectral reflectance of the snow and water, an algorithm was applied to calculate the spectral reflectance of the ice types measured from 300 m, corrected for atmospheric attenuation and path radiance. ESA

N87-11281# Department of Civil Engineering, Indore (India).
RADIOMETRIC DATA CHARACTERIZE QUANTIZATION OF SOIL FORMING MINERALS
H. S. Mehta *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 249-251 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Spectral signatures of the soil forming minerals like serpentine, gypsum, clay, quartz, barium sulfate, calcite, dolomite, feldspar, chlorite, biotite, and bentonite were studied. Ground truth was measured by a radiometer compatible to Landsat MSS bands and ISRO model, spectrometer operating in 460 to 1010 nm range with 10 nm spectral resolution, and a spectrophotometer. The spectroradiometer and spectrophotometer data are used to correlate field and laboratory data, respectively. Statistical and graphical analysis of all data show that barium sulfate has the highest spectral reflectance and biotite the lowest. ESA

N87-11282# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
SPECTRAL SIGNATURES OF COASTAL OBJECTS
M. Viollier, T. Belscher, and L. Loubersac *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 253-256 In FRENCH; ENGLISH summary (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Spectral signatures were measured in coastal areas using a high resolution spectroradiometer and a SPOT simulation radiometer. Optical indexes for characterization of seaweeds and strand facies are derived. ESA

N87-11283# Ecole Normale Superieure, Paris (France). Lab. de Geographie.
REFLECTANCE OF STRAND SEDIMENTS: RESULTS OF IN SITU MEASUREMENTS AND A SPOT SIMULATION IN MONT SAINT MICHEL BAY [LES REFLECTANCES DE SEDIMENTS D'ESTRAN: RESULTATS DE MESURE IN-SITU ET D'UNE SIMULATION SPOT EN BAIE DU MONT SAINT-MICHEL]
R. M. Zbinden *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing

Dec. 1985 p 257-263 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The reflectance spectra of sands, dunes, and sediments forming morphosedimentary units typical of strands, identifiable by a SPOT satellite 20 m by 20 m pixel was studied by spectroradiometry. The relations between reflectance, granulometry, surface water content, and sediment calcimetry are shown. Regions where the activity of microalgae mask the signature of fine sediments are revealed. ESA

N87-11284# Oldenburg Univ. (West Germany).
LASER REMOTE SENSING OF THE MARINE ENVIRONMENT: RECENT RESULTS OBTAINED WITH THE OCEANOGRAPHIC LIDAR SYSTEM
D. Diebel-Langhor, T. Hengstermann, and R. Reuter *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 267-272 Sponsored by Commission of the European Communities, Ispra, Italy, Bundesministerium fuer Forschung und Technologie, Bonn, Deutsche Forschungsgemeinschaft, Bonn, and Niedersaechsisches Ministerium fuer Wissenschaft und Kunst, Hannover, West Germany (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A lidar system for research in the coastal zone was developed. Based on spectroscopic methods, data relevant for oceanographic studies and for marine pollution monitoring are obtained. Operated from aircraft, a nearly synoptic investigation of extended areas is achieved. The system was utilized in experiments in the North Sea and the Adriatic. Data on the spectral light turbidity and on the concentration of dissolved organics (Gelbstoff) and chlorophyll-a are reported. By use of nanosec laser pulses and a fast signal receiver depth profiles of the attenuation coefficient down to 6 attenuation lengths were measured. Airborne measurements were performed over marine oil spills. They allow a determination of the oil type, and of the oil film thickness in the micrometer range. ESA

N87-11285# Technische Univ., Munich (West Germany).
THE CO2 LASER IMAGING SPECTROSCOPY FOR EARTH OBSERVATION
F. Lehmann and W. Wiesemann (Battelle Inst., Frankfurt am Main (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 273-276 Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Based on the results of CO2-laser laboratory spectroscopy (laser reflection spectroscopy of minerals, soils, rocks, vegetation, moistened surfaces, water, oil spills on water, in the wavelength interval 9.2 to 10.8 microns), and airborne campaigns with the 2-laser profiling instrument DIALEX, a program for the development of an optical multisensor Lidar Multispectral Earth Observation System was started. It combines four CO2-laser imaging spectrometers and an airborne thematic mapper multispectral scanner, to be flown in a Dornier 228 aircraft. ESA

N87-11286# Bern Univ. (Switzerland). Inst. of Applied Physics.
CAN MICROWAVE SIGNATURES BE USED TO RETRIEVE THE WATER EQUIVALENT OF A DRY SNOW PACK?
C. Maetzler *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 277-284 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Based on a long-term program of measuring the interaction of microwaves with the seasonal snow cover at an alpine test site, the potential of microwave remote sensing to retrieve the water equivalent (WE) of the snowpack was tested. For dry winter snow a reasonable estimate is possible for WE less than 80 cm. However, a number of natural disturbances limit this potential. Some changes of the microwave observables can be corrected, others have effects which cannot be determined. It is found that a combination of microwave brightness temperatures tends to enhance the discriminability of dry snow and, simultaneously, cancels effects of the disturbances. This parameter should be used in tests with airborne and satellite data. ESA

N87-11287# Chiba Univ. (Japan). Faculty of Engineering.
IN-VIVO CHLOROPHYLL DETERMINATION OF PLANTS BY LASER-INDUCED FLUOROMETER
K. Takahashi, Y. Emori, Y. Yasuda, and A. Kimura *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 285-288 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Fluorescence spectra of leaves of evergreen and deciduous trees were examined, and the potential of laser induced fluorescence measurement (LIF) in detection of species of trees was assessed. Results show that measurement of LIF of chlorophyll-a in leaves gives a useful means of detecting forest tree information. However, the fluorescence spectra and intensity of the green of of evergreen leaves is not detected by laser at 337.1 nm. Application of LIF to forest trees would not appear to be reliable. ESA

N87-11288# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MICROWAVE SCATTERING LOSS OF DRY SNOW
M. T. Hallikainen *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 289-292 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The extinction coefficient of several snow types at 5 frequencies between 10 GHz and 90 GHz was determined. The temperature of the samples was minus 15 C. Since the dielectric loss of dry snow is low, the extinction coefficient is, in practice, equal to the scattering coefficient. The experimental loss behavior of the samples does not follow the theoretical behavior predicted by Mie theory (assuming spherical snow particles). The measured loss varies substantially depending on the snow type. At 90 GHz maximum and minimum values are 300 dB/m and 15 dB/m, respectively. At 10 GHz the loss is negligible for all snow types. The loss due to surface scattering effects is substantial for refrozen snow at 60 and 90 GHz. ESA

N87-11289# Academia Sinica, Guiyang (China). Inst. of Geochemistry.
MICROWAVE DIELECTRIC PROPERTIES OF MINERALS AND ROCKS
Jin-kai Xiao *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 293-296 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The resonant cavity perturbation method at 9.4 GHz was used to measure the dielectric constants of minerals and rocks. Dielectric properties of the minerals and rocks are summarized. The effects of composition, moisture, and other factors on dielectric properties are discussed. Application of dielectric constant to microwave remote sensing and the correlation between the dielectric constant of the geological objects and the gray-scale values of the SIR-A image are analyzed. ESA

N87-11290# Centre National d'Etudes Spatiales, Toulouse (France).
MICROWAVE SIGNATURES OF SEA ICE IN THE FRAM STRAIT (GREENLAND) IN SUMMER [SIGNATURES MICRO-ONDES DE LA GLACE DE MER EN ETE DANS LE DETROIT DE FRAM]
N. Lannelongue and C. Schgounn *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 297-301 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The backscattering coefficient of sea ice was measured at ground level in summer at null incidence by a scatterometer at 13.6 GHz. Results show that the backscattering coefficient follows variations in air temperature. For oblique angles (less than 30 deg) the backscattering coefficient increases with crystal diameter. At these incidences, old ice and first year ice can be distinguished. ESA

N87-11291# Quebec Univ., Chicoutimi. Lab. de Physique Atmospherique.

ANEMOTHERMOGRAPHIC REMOTE SENSING USING AIRBORNE SENSORS: A NEW METHOD OF MICROMETEOROLOGICAL CARTOGRAPHY [LA TELEDETECTION ANEMOTHERMOGRAPHIQUE PAR CAPTEUR AEROPORTE: UNE NOUVELLE METHODE DE CARTOGRAPHE MICROMETEOROLOGIQUE]

R. Verreault, G. Vachon, G. H. Lemieux, M. Labonte, and S. Perron *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 303-306 In FRENCH Sponsored by Institut Scientifique du Saguenay, Canada, and Quebec Government's Fonds pour la Formation de Chercheurs et l'Aide a la Recherche, Canada (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

A method for measuring atmospheric circulation in the atmospheric boundary layer was developed. It uses night time aerial photography by flash lamp at altitudes up to 2500 m. A network of analogical and/or digital transducers measures other meteorological parameters such as surface and atmospheric temperature and moisture content. Anemography was used to study circulation during a temperature inversion at night in an orchard featuring radiative freezing. ESA

N87-11292# Arizona Univ., Tucson. Optical Sciences Center.

ABSOLUTE CALIBRATION OF REMOTE SENSING INSTRUMENTS c35

S. F. Biggar, C. J. Bruegge, B. A. Capron, K. R. Castle, M. C. Dinguirard, R. G. Holm, L. J. Lingg, Y. Mao, J. M. Palmer, A. L. Phillips et al *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 309-314 Sponsored by NASA (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

Source-based and detector-based methods for the absolute radiometric calibration of a broadband field radiometer are described. Using such a radiometer, calibrated by both methods, the calibration of the integrating sphere used in the preflight calibration of the Thematic Mapper was redetermined. The results are presented. The in-flight calibration of space remote sensing instruments is discussed. A method which uses the results of ground-based reflectance and atmospheric measurements as input to a radiative transfer code to predict the radiance at the instrument is described. A calibrated, helicopter-mounted radiometer is used to determine the radiance levels at intermediate altitudes to check the code predictions. Results of such measurements for the calibration of the Thematic Mapper on Landsat 5 and an analysis that shows the value of such measurements are described. ESA

N87-11293# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.

ATMOSPHERIC EFFECTS IN REMOTE SENSING: A PROGRAM TO SIMULATE SATELLITE SIGNALS IN THE SOLAR SPECTRUM [EFFECTS ATMOSPHERIQUES EN TELEDETECTION: LOGICIEL DE SIMULATION DU SIGNAL SATELLITAIRE DANS LE SPECTRE SOLAIRE]

D. Tanre, C. Deroo, P. Dahaut, M. Herman, J. J. Morcrette, J. Perbos, and P. Y. Deschamps *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 315-319 In FRENCH Sponsored by CNRS, CNES, and ESA (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

A computer program which simulates atmospheric radiation effects on satellite tracking signals and data from satellites was developed. The program enables the signal measured at the sensor to be estimated. It takes into account surface reflectance and the effects of the double transversing of the atmosphere: Sun-surface and surface-satellite. Atmospheric absorption and scattering are included. ESA

N87-11294# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE FIRST INTERNATIONAL SATELLITE LAND-SURFACE CLIMATOLOGY PROJECT (ISLSCP) FIELD EXPERIMENT (FIFE)

T. J. Schmugge and P. J. Sellers *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 321-325 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

The International Satellite Land Surface Climatology Project (ISLSCP) will verify the use of satellite data for the estimation of land-surface properties through field experiments using point measurements on the ground and areal measurements from aircraft overflights. In addition to validating satellite estimates of surface properties, it studies approaches for obtaining areal averages of the radiation, moisture and heat fluxes made using remotely sensed data. The procedure suggested combines the surface point measurements of the fluxes with the aircraft areal observations using a surface energy balance model to interpolate between the point estimates of these fluxes and calculate area-averaged quantities. The surface parameters to be estimated from aircraft observations include: surface radiation temperature, albedo, land cover or vegetation index, and surface soil moisture (the latter to be obtained using passive and active microwave approaches). The area-averages of the surface properties are compared with satellite data where possible. The First ISLSCP Field Experiment is planned for 1987 at a site having relatively uniform vegetation cover in the central great plains of the USA. for 1987 at a site having relatively uniform vegetation cover in the central great plains of the USA. ESA

N87-11295# Scripps Institution of Oceanography, La Jolla, Calif.

CALIBRATION OF GOES-5 AND GOES-6 VISSR/VAS SHORT-WAVELENGTH CHANNELS c35

R. Frouin and C. Gautier *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 327-333 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

The GOES-5 and GOES-6 VISSR/VAS short wavelength channels are calibrated for the periods from October 1983 through July 1984 (GOES-5) and from October 1983 through January 1985 (GOES-6). The White Sands Monument area in New Mexico and space are used as calibration targets. The radiance directed to the satellite from the surface target is computed using a radiative transfer model. Measured surface and atmospheric properties are used as input to the model. The coefficients relating the brightness count (CN) to the incident radiance R (R=aC-Nsq+b) are found to vary little (10%) from the mean values for the entire study periods, indicating the good behavior of the instruments in orbit. The mean values are 0.0083 W/sqm/sr/micron (GOES-5) and 0.0089 W/sqm/sr/micron (GOES-6) for a; and -5.2 (GOES-5) and -7.1 (GOES-6) for b. ESA

N87-11296# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PRELIMINARY RESULTS OF A QUANTITATIVE COMPARISON OF THE SPECTRAL SIGNATURES OF LANDSAT THEMATIC MAPPER (TM) AND MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS).

J. Bodechtel (Technische Univ., Munich (West Germany).), J. Zilger, and V. V. Salomonson *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 335-341 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

Operationally acquired Thematic Mapper and experimental MOMS-01 data are evaluated quantitatively concerning the systems spectral response and performance for geoscientific applications. Results show the two instruments to be similar in the spectral bands compared. Although the MOMS scanner has a smaller IFOV, it has a lower modulation transfer function performance for small, low contrast features as compared to Thematic Mapper. This deficiency does not only occur when MOMS was switched to the low gain mode. It is due to the CD arrays used (ITEK CCPD 1728). ESA

N87-11297# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.

MULTISPECTRAL AERIAL PHOTOGRAPHY YIELDING WELL-CALIBRATED REFLECTANCE FACTORS WITH HIGH SPECTRAL, SPATIAL AND TEMPORAL RESOLUTION FOR CROP MONITORING

J. G. P. W. Clevers *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 343-346 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

An airborne multispectral photographic system was designed for crop monitoring. Spectral resolution is: 555 to 580 nm (green), 665 to 700 nm (red) and 840 to 900 nm (infrared). Equipment which was easily available and relatively inexpensive was used, resulting in a high temporal resolution (fortnightly). Using a densitometer with an aperture of 0.25 mm diameter, results in a high spatial resolution (3.14 sqm at scale 1:8000 and 0.44 sqm at 1:3000). With low altitude multispectral photography, reference targets were set up in the field for obtaining calibrated spectral data of crops. High temporal and spatial resolution requirements were satisfied by aerial photography. Results prove the validity of the applied procedure for atmospheric correction and radiometric calibration, resulting in information about crops with larger precision than by conventional field sampling methods. ESA

N87-11298# Technische Univ., Munich (West Germany). Faculty of Geosciences.

CALIBRATION OF MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER CHARGED COUPLE DEVICE (MOMS-CCD) DATA AND QUALITATIVE TEST USING THEMATIC MAPPER (TM) DATA **c35**

J. Henkel and H. Kaufmann (Karlsruhe Univ. (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 347-350 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

Relative and absolute radiometric calibration of MOMS-CCD-Data are demonstrated using a part of an image near Nakuru, Kenya. Preflight calibration data are used for the absolute correction, variance and mean value for relative correction. Landsat-TM Data of the same region are chosen for comparison. To test different sensor data ratio, principal component analysis is applied. ESA

N87-11299# Bern Univ. (Switzerland). Inst. of Applied Physics.

CALIBRATED MICROWAVE SIGNATURE MEASUREMENTS OF SOIL AND WHEAT

R. Hueppi, E. Stotzer, and E. Schanda *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 351-355 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

Emissivities and backscattering coefficients of cultivated fields were measured with a truck-mounted radiometer-scatterometer. The seven channel radiometer works from L to X band with simultaneous H and V polarization and at various nadir and azimuth angles. The noise scatterometer, using the radiometer as receiving part, is designed for like and cross polarization measurements. The microwave signatures are correlated with soil and vegetation parameters. These parameters include soil moisture, dielectric constant and state of growth. Results for bare soil and for wheat are presented. ESA

N87-11300# Stockholm Univ. (Sweden). Dept. of Physical Geography.

A COMPARISON BETWEEN LANDSAT-THEMATIC MAPPER (TM) DATA AND GROUND MEASURED RADIANCE AND SOIL DATA

B. Lunden and E. Fagerlund *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 357-360 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

In order to evaluate Landsat-TM radiance data for bare soils in an agricultural area in central Sweden, a satellite registration was compared with black and white IR air photo densities, field measured radiance data (0.4 to 1.1 microns) and soil data (water content, humus content and grain size distribution) from the same 24-hr period. By means of an air photo, the TM pixels were positioned for comparisons with field data. When comparing satellite data with air photo densities, correlation factors ($r = Rxy$) from 0.87 to 0.90 are obtained and with the radiometer data from 0.82 to 0.84. Correlation between TM data and soil water content, the best correlated soil parameter, varies from -0.86 for band 7 to -0.89 for band 2. ESA

N87-11301# Joint Research Centre of the European Communities, Ispra (Italy).

ANALYSIS OF MULTILEVEL MEASUREMENTS OF SPECTRAL SIGNATURES FOR LESS-FAVORED AREAS

G. Marrachi, G. Andreoli, P. Grassi, B. Hosgood, and M. Verbrugghe *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 361-363 (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

The role of remote sensing in economically less-favored areas was studied using spectral signatures measured in situ; airborne radiometer data; and thematic mapper satellite data. Data analysis reveals the difficulties in comparing space and ground data owing to the heterogeneity of the spatial element from which they derive. The spectral signature concept is quite well defined at ground level while the spatial averaging effect becomes more important from higher view level (500 m) up to satellite level at which the effect due to mixed pixels can completely alter the results. The analysis is intended to provide the limits of a reliable classification based on spectral signatures. An attempt to develop the analysis on a multitemporal scale is described. ESA

N87-11302# Universite de Bretagne Occidentale, Brest (France). Lab. d'Oceanographie Physique.

AVHRR DATA PROCESSING FOR UTILIZATION IN DYNAMICAL OCEANOGRAPHY **c48**

V. Mariette and V. Verbeque *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 365-369 Sponsored by CNRS and Inst. Francais de la Recherche pour l'Exploitation de la Mer (For primary document see N87-11238 02-43)

Avail: NTIS HC A25/MF A01

Infrared satellite imagery was compared with an oceanographic cruise in tidal seas. The AVHRR data of NOAA7 geometrically corrected and registered with regard to a Mercator projection were calibrated to obtain sea surface temperature (SST) using a combination of the 11 and 12 micron channels. Analyses of satellite data show that, during the night, the bias is small (0.2 C). In the day time, despite the same pattern for the dynamical structure, SST given by satellite is higher than measured in situ by 1.5 C. To explain these differences, the influence of the energy budget at the air-sea interface upon the upper layer of the ocean was studied. Rather than the use of SST images for the study of evolution of the frontal areas in tidal seas, thermal gradient image analysis is proposed. ESA

N87-11303# Scripps Institution of Oceanography, La Jolla, Calif.
DOWNWARD LONG-WAVE IRRADIANCE AT THE OCEAN SURFACE USING SATELLITE DATA c48
C. Gautier and R. Frouin *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 371-374 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Two methods to estimate the downward longwave irradiance at the ocean surface from a radiative transfer model and satellite observations were developed. Both are based on physical radiative modeling of the longwave radiation in the atmosphere and on satellite observations of atmospheric profiles and clouds. While the radiative effects of clouds are explicitly taken into account in method A, they are only parameterized in method B. The two methods were tested by comparing satellite estimates with surface mesurements made during MILDEX (Oct-Nov 1983). For method A, the correlation coefficient (r) and the standard error (se) are: 0.69 and 23 w/sqm for half-hourly averages and 0.73 and 18 w/sqm for daily averages. For method B, r = 0.58 and se = 24.9 w/sqm for half-hourly averages and 0.53 and 21.7 w/sqm for daily averages. ESA

N87-11304# Sherbrooke Univ. (Quebec).
VARIATION OF ATMOSPHERIC EFFECTS ON MEASURED RADIANCE AS A FUNCTION OF IMAGING ALTITUDE [VARIATIONS DES EFFECTS ATMOSPHERIQUES SUR LES RADIANCES MESUREES EN FONCTION DE L'ALTITUDE DE PRISE DE VUE]
A. Royer, F. Nerry, P. Teillet (Canada Centre for Remote Sensing, Ottawa (Ontario).), and S. Till *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 375-381 In FRENCH (For primary document see N87-11238 02-43)
(Contract CNRC-OSU83-0094))
Avail: NTIS HC A25/MF A01

The effects of atmospheric scattering in the visible and near infrared wavebands on the radiance of water measured by remote sensing were anaiyzed using data from 3 overflights of the MEIS-2 pushbroom imager at different altitudes. It is shown that over continents, taking into account a vertical aerosol profile according to an exponential law defined by two parameters, the volume reflectance of water for each altitude produces equal values. In marine environment, a law of variation of the optical thickness of aerosols in proportion to altitude, defined by one parameter, enables the volume reflectance of water for each altitude to be evened out to within 0.05%. The method can provide accurate analyses for operational applications to image correction without ground measurements during overflights. ESA

N87-11305# Rijkswaterstaat, The Hague (Netherlands). Survey Dept.
AN ATMOSPHERIC CORRECTION METHOD USING GUZZI-SPECTRORADIOMETER INPUT DATA
L. M. M. Veugen and H. T. C. vanStokkom *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 383-388 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

An atmospheric correction method using input data of a Guzzi-spectroradiometer is presented. The data consist of global and diffuse irradiance data in nine wavelength intervals in the visible and near infrared. The irradiance data are transformed to aerosol spectral optical thicknesses using the model presented in Stokkom and Guzzi (1984). A linear inversion procedure makes possible the computation of the size distribution of the local aerosols. This distribution is used as input for the direct calculation of the transmittances at the wavelength bands of the remote sensor, and for the computation of the aerosol phase function. Together with the known Rayleigh phase function, the diffuse irradiance at the remotely sensed object and the path radiance at the satellite borne sensor are obtained using a Sobolev modified approximate radiative transfer model (SMART-model). ESA

N87-11306# Nottingham Univ. (England). Dept. of Geography.
ESTIMATION OF ATMOSPHERIC CORRECTIONS FROM MULTIPLE AIRCRAFT IMAGERY
M. D. Steven and E. M. Rollin *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 389-392 Sponsored by UK Natural Environment Research Council (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Multiheight measurements from aircraft are used to estimate atmospheric transmittance and path radiance using the known dependence of transmittance on path length. Multiangle measurements from overlapping scans were also applied, but the difference of path lengths offered by the range of scanner angles was insufficient to determine the parameters with accuracy especially with the uncertainties introduced by non-Lambertian reflection. The atmosphere is not horizontally homogeneous in the presence of cloud and even on cloudless days variations in optical depth can occur in dense haze. The variations have a coherent spatial distribution which can be applied to distinguish zones of different atmospheric characteristics. ESA

N87-11307# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE SENSING OF ATMOSPHERIC WATER USING THE FUTURE AMSU SYSTEM
G. Szejwach, I. Jobard (Ecole Polytechnique, Palaiseau (France).), and O. Z. Zaniffe *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 393-396 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Microwave radiances for various conditions of atmospheric temperature, moisture and cloudiness at the frequencies of the AMSU passive sounder system were computed. Results emphasizing precipitating cases are presented. Results from a parameterization scheme to infer total cloud liquid content as well as precipitable water over the ocean are also presented. ESA

N87-11308# Academia Sinica, Guiyang (China). Inst. of Geochemistry.
SPECTRAL STUDY OF ROCKS AND SOME IRON DEPOSITS FROM EASTERN CHINA
Bai-lin Yang and Xuan Ding *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 399-402 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Iron deposits and related rocks from Eastern China are measured to acquire visible and near infrared reflection and infrared absorption spectra on powders and natural outcrops. The study shows that spectral features are related with chemical and mineral compositions of rocks and ores. The absorption bands are caused by H2O and OH (1-) at 1400, 1900, and 2200 nm; CO3 (2-) causes the spectral band at 2300 nm. The absorption bands near 900 and 1100 nm are caused by Fe (3+) and Fe (2-). Infrared spectra of rock alteration products show that kaolinite, quartz, and albite are spectrally sensitive. The typemorphic band of kaolinite is 915 nm. Quartz displays a well-defined double band at 800 and 780 nm, and albite associated absorption spectra (784, 758, 740, and 720 nm). ESA

N87-11309# Research Center Graz (Austria).
SPECTRAL ANALYSIS OF A HEAVY METAL-STRESSED FOREST CANOPY USING LANDSAT TM DATA
C. Banninger *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 403-407 Sponsored by ESA (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Landsat Thematic Mapper (LTM) data acquired in the spring over a metal-stressed coniferous tree stand were used to evaluate their usefulness in detecting geobotanical anomalies associ-

ated with high concentrations of heavy metals in the underlying soil, and to ascertain which ground parameters exert the greatest influence on the recorded data. Thematic Mapper bands 4 and 5, simple band ratio (R41), normalized difference (ND1), first principal component (PC1), band differences (BD1, BD2, and BD3), and the green and brightness indices (TMG and TMB) best discriminate copper-lead-zinc related stress conditions in a spruce tree stand of 30 TM spectral bands and transformations are evaluated. Overall, ND1 and BD1 are the most useful for detecting heavy metal stress in coniferous forests, followed closely by TMG, R41, and BD3. ESA

N87-11310# Institut National de la Recherche Agronomique, Avignon (France). Dept. de Bioclimatologie.
INVESTIGATION OF THE COMPLEMENTARITY OF THE MIDDLE INFRARED WITH THE VISIBLE AND NEAR INFRARED SPECTRA FOR VEGETATION MONITORING [ETUDE DE LA COMPLEMENTAIRE DU MOYEN INFRAROUGE AVEC LE VISIBLE ET LE PROCHE INFRAROUGE POUR LE SUIVI DE LA VEGETATION]
F. Baret, G. Guyot, A. Begue, P. Maurel, and A. Podaire (Centre National d'Etudes Spatiales, Toulouse (France).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 409-412 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The advantages of adding a mid IR channel to the visible and near IR ones of the SPOT satellite for vegetation monitoring were assessed by testing the 1660 to 1695, 1560 to 1685, and 2030 to 2235 nm bands (close to Landsat Thematic Mapper 5 and 7 bands). The 1560 to 1685 nm band provides most information. However, vegetation moisture supply has little influence on the spectral response of canopies in this band. The band is most sensitive to surface optical properties (influenced by soil moisture content) governed by leafiness for a given leaf area index. Canopies with different geometrical structures can be distinguished. ESA

N87-11311# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
AN INVESTIGATION OF SPECTRAL SIGNATURES FROM MINERALISED ROCK OUTCROP AS DEFINED BY AIRBORNE TM DATA OF THE SAUDI ARABIAN SHIELD
A. C. Bird, G. R. Garrard, A. R. Iles, W. P. Loughlin, M. A. Tawfiq, and C. A. Legg *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 413-417 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Mineral exploration test sites were selected from an airborne thematic mapper data set covering 30,000 sq km of the Saudi Arabian Shield. In order to study the 11 waveband characteristics of the data, a variety of surface materials was selected from each of 4 test sites and average DN values extracted. The results are presented in tables that rank the surface materials in order of brightness and in graphs that present normalized radiance curves. The tables and graphs aid selection of color composites for discriminating materials. It is also possible to suggest more complex processes that would be useful for the interpretation of the data. The results support the band combination selected for the existing hard copy. ESA

N87-11312# Paris VI Univ. (France). Lab. de Mineralogie et Cristallographie.
EVALUATION OF SPOT FOR MAPPING SEDIMENTARY AND VOLCANIC ROCKS [EVALUATION DE SPOT PUR LA CARTOGRAPHIE DE ROCHES SEDIMENTAIRES ET VOLCANIQUES]
B. Cervelle, J. Chorowicz, L. Epiard-Moreau, J. P. Rudani, and A. Bothorel *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 419-423 In FRENCH Sponsored by SPOT IMAGE, and CNES, Toulouse, France (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A SPOT satellite simulation in the Coconino plateau (Arizona) determined the spectral signatures of sedimentary and volcanic rocks from three types of data: laboratory spectra from samples taken from outcrops; ground radiometric measurements in the three SPOT bands; and airborne radiometry data from eight bands, inciuding the thermal infrared. Comparisons show that the SPOT bands cannot identify the lithologies directly (except for hematite soils) but can only differentiate them with respect to known, calibrated zones. The SPOT spatial resolution greatly increases the chances of obtaining petrologically homogeneous pixels. Analysis of airborne data reveals the utility of adding a 1.6 or 2 micron, or thermal, band. ESA

N87-11313# Centre National de la Recherche Scientifique, Montpellier (France). Centre Emberger.
ANALYSIS OF SPOT SIMULATION RADIOMETRIC MEASUREMENTS IN ARID AND SUBHUMID MEDITERRANEAN ENVIRONMENTS [ANALYSE DE MESURES RADIOMETRIQUES DE SIMULATION SPOT EN MILIEUX MEDITERRANEENS ARIDE ET SUB-HUMIDE]
B. Lacaze, L. Lahraoui, G. Debussche, and A. Khelfa *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 425-428 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Ground and airborne radiometric measurements were carried out in Mediterranean regions to simulate SPOT satellite performance. Results for the three SPOT channels for the reflectance of the dominant vegetation species are presented. Large scale spatial structure and the average spectral response of the vegetation are revealed. ESA

N87-11314# Agricultural Univ., Poznan (Poland).
RELATION BETWEEN SOIL MOISTURE TENSION AND SPECTRAL REFLECTANCE OF DIFFERENT SOIL IN VISIBLE AND NEAR-INFRARED RANGE
J. Cierniewski *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 429-432 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Laboratory spectrophotometrical measurements from 440 to 860 nm were used to determine the mathematical relation between soil water tension and spectral reflectance of bare soils. They were conducted on samples belonging to initial loose denudative soils, typic and eroded gray brown podsolic soils, and typic and degraded black earths. Each of the 88 analyzed soil samples was tested in 12 different moisture conditions from 0 to 7 pF. The discussed relation was described by quadratic equations. Using the relative spectral reflectance coefficient makes possible the practical elimination from this relation of the influence of the soil texture and soil genesis. ESA

N87-11315# Sheffield Univ. (England). Dept. of Geography.
CHARACTERISING VEGETATED SURFACES WITH AIRBORNE MSS DATA
P. J. Curran and H. D. Williamson *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 433-436 (For primary document see N87-11238 02-43)
(Grant SERC-GR3/5096)
Avail: NTIS HC A25/MF A01

Airborne multispectral scanner (MSS) data collected in June were used to estimate the green leaf area index (GLAI) of grassland. The initial accuracy of GLAI estimation was 17% to 40% at the 95% confidence level, for a 6 class classification. By refining the methodology, the accuracy increases to 60% to 82% at the 95% confidence level, for a 5 class classification. To test the methodology the experiment was repeated for the same study area using data collected in August. The initial accuracy of GLAI estimation was 5% to 40% at the 95% confidence level for a 6 class classification, Using the refined methodology the accuracy in-

creases to 58% to 93% at the 95% confidence level for a 5 class classification. ESA

N87-11316# California Univ., Santa Barbara.
SPECTRAL SIGNATURE OF SNOW IN VISIBLE AND NEAR-INFRARED WAVELENGTHS
J. Dozier *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 437-442 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Snow reflectance measurements in the near-infrared (Landsat Thematic Mapper band 4) estimated an effective radiative grain radius, while a measurement in the visible (TM band 2) estimated the extent to which snow albedo is degraded by contamination. The combination of these parameters can be used to calculate snow albedo throughout the solar spectrum. The effective grain radius is approximately the spherical radius that corresponds to the volume/surface ratio of the actual grains. Snow can be distinguished from water and ice clouds in TM band 5, because water is less absorptive than ice in this band and the small crystals in cirrus clouds are more reflective than the larger snow grains. ESA

N87-11317# Joint Research Centre of the European Communities, Ispra (Italy). Centre Commun de Recherche.
GROUND LEVEL RADIOMETRIC MONITORING OF RAINY SEASON FOOD CROPS IN THE SAHEL [SUIVI RADIOMETRIQUE AU SOL DE CULTURES VIVRIERES PLUVIALES EN ZONE SAHELIENNE]
A. Hubaux, G. Ferrari, and J.-M. Gregoire *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 443-449 In FRENCH; ENGLISH summary (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

During the rainy season, relative reflectance measurements were collected on 14 plots of millet, sorghum, and peanuts near Segou, Mali, using a radiometer. The influence of plant phenology and cover percentage on spectral behaviour were studied. The data analysis method, consisting in highlighting all channel space angular relationships with stereograms proves to be an efficient interpretation tool. Correlation between biomass index and yellowing index is quantified for all studied crops. Bare soil effect is determinant to distinguish between millet and sorghum (which has a higher biomass index). Distinction between millet and sorghum, and peanuts may be based on shifts between growth cycles. ESA

N87-11318# Tokyo Univ. (Japan). Inst. of Space and Astronautical Sciences.
MEASUREMENTS OF MICROWAVE BACKSCATTER FROM TREES
H. Hirosawa, H. Ishida, T. Ochi, and Y. Matsuzaka *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 451-454 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Microwave backscatter from two kinds of conifers, Sugi (Japanese cedar) and Sawara (Japanese cypress), at C and X bands, using HH, VV, HV, and VH polarizations was measured. The relationship between the backscattering characteristics and the ground truth data: leaf moisture content, volume ratio of leaves, and calculated dielectric characteristics of leaves and the medium is discussed. ESA

N87-11319# Stockholm Univ. (Sweden). Dept. of Physical Geography.
SPECTRAL MEASUREMENTS FOR ESTIMATION OF BIOMASS ON LIMESTONE GRASSLAND
M. Ihse and E. Rosen *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 455-458 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Green biomass in grassland was estimated through spectral reflectance measurements, using a hand-held instrument. The relationship between the green biomass and the IR/R reflectance ratio was investigated in the dominant plant communities: the Arrbenatherum pratense-community, the Sesleria caerulea-community and the Festuca ovina-community. The best linear correlations are achieved for the A pratense and the S caerulea for the growing phase (rsq = 0.90, 0.96) while correlation is poorer for the F ovina (rsq = 0.56). Several factors influence the relationship: plant community, phenology, vegetation cover, grazing, and strongly colored flowers. There is a strong phenological influence between the growing, maturity and senescense phases (rsq = 0.87, 0.70, 0.96 for A pratense). A good estimate of the average green biomass during the growing phase (+or- 9%) can be made. ESA

N87-11320# Freiburg Univ. (West Germany). Abt. Luftbildmessung und Fernerkundung.
INVESTIGATION OF SPECTRAL REFLECTANCE SIGNATURES ON FOREST DAMAGES USING MULTISPECTRAL DATA
A. Kadro *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 459-462 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Multispectral visible, near infrared and middle infrared spectra were collected over forests at three flight altitudes. Spectral reflectance signatures and a computer aided classification based on the different signatures, for use in a forest damage inventory, are presented. ESA

N87-11321# Stockholm Univ. (Sweden). Remote Sensing Lab.
REFLECTANCE PROPERTIES OF CONIFERS, MEASURED FROM A HELICOPTER
J. Kleman *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 463-466 Sponsored by Swedish Board for Space Activities (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Radiometer measurements from helicopter were carried out over stands of Norway spruce (Picea abies) and Scotch Pine (Pinus sylvestris) 20 km north of Stockholm, Sweden. Continuous reflectance spectra in the wavelength range 0.4 to 1.7 microns were measured over forest stands with different species, ages, crown densities, and field layers. The average reflectances of pine stands with an age of over 40 yr are higher in all bands than the reflectances for comparable spruce stands. In rank order, bands centered at 0.67, 1.6, and 0.48 microns offer the best separation possibilities. The reflectance variations through the summer are small for the two species. The reflectance of the pine stands varies less with deviations from nadir looking than the reflectance of the spruce stands. ESA

N87-11322# Institut National de Recherche d'Informatique et d'Automatique, Rennes (France).
CHARACTERIZATION OF THE SPECTRAL, SPATIAL AND TEMPORAL SIGNATURE OF VINEYARDS AND ORCHARDS: APPLICATION TO SOIL AND CROP REMOTE SENSING [CARACTERISATION DE LA SIGNATURE SPECTRALE, SPATIALE ET TEMPORELLE DES VIGNES ET VERGERS: APPLICATION A LA TELEDETECTION DU SOL ET DE LA CULTURE]
B. Naert *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 467-474 In FRENCH (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The behavior of the spectral signature of pixel components throughout a growth cycle was studied using data from a radiometer operating in the three bands of the SPOT satellite and airborne color infrared photography. Results show that at high resolution, vegetation, bare soil, and shade in vineyards and orchards can be identified. With a decimetric pixel, significant growth stages of the vine are identifiable. At 20 m satellite resolution, only agricultural features are distinguished. Between the two, surface heterogeneity

in the plot can be detected. The relationship between wavelength and identifying parameters, such as soil moisture and reflectance, indicates that in complex cultivated areas every signal parameter must be mastered to permit efficient remote sensing. ESA

N87-11323# Paris VI Univ. (France). Lab. de Mineralogie et Cristallographie.
SPECTRAL SIGNATURES AND MAPPING OF MINERAL DEPOSITS OF SOUTH MOROCCO [SIGNATURES SPECTRALES ET CARTOGRAPHIE DE GISEMENTS MINIERS AU SUD DU MAROC]
B. Cervelle, P. Boucher, J. Chorowicz, G. Tamain, and E. M. Alem *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 475-480 In FRENCH Sponsored by Ministere de la Recherche et de la Technologie (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Landsat multispectral scanner data of three arid zones containing mineral deposits of different types were analyzed to obtain spectral signatures and to map their lithologies (mineral bearing or not). The digital data associated with pixels characteristic of geological structures were corrected for atmospheric absorption and transformed to surface reflectance values. This enabled them to be compared with ground radiometer data and to calibrate them using laboratory spectrometric measurements on weathered rocks. A map of the three deposits was made. ESA

N87-11324# Valencia Univ. (Spain). Dept. of Thermography.
FOLLOWING THE MICROCLIMATIC ALTERATIONS PRODUCED BY FOREST FIRES BY MEANS OF LANDSAT-5 TM SENSOR
M. J. Lopez-Garcia, V. Caselles, and J. Melia *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 481-484 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The microclimatic variation produced by a forest fire was evaluated by comparing Landsat 5 TM sensor data with reference area temperature and Monitoring Index (MI) B4-B7/B4+B7. A month after the fire, the areas affected present temperatures 2 to 3 C higher than the reference areas, and the MI shows a negative value. These differences decrease with time and are not significant 6 yr after the fire. The sensor is considered to be especially suitable to monitor the reforestation of the areas affected by forest fires. ESA

N87-11325# Reading Univ. (England). Dept. of Geography.
SPECTRAL SIGNATURES OF LAND COVER TYPES IN THE SAHEL FOR GEOBOTANICAL MODELING
A. C. Millington *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 485-489 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A geobotanical model based on soil moisture stresses in vegetation for geomorphological mapping is established for the Gambia and central Senegal. Ground radiometric measurements of visible and near IR reflectances were made and the reflectances in the equivalent Landsat multispectral scanner bands 5, 7, 7/5 and the normalized difference vegetation index are calculated and used to test the model. The Mann-Whitney U-test is used to test for statistical separability between land cover classes which are related to geomorphological boundaries. The potential for mapping flood plain geomorphology and exposures of ferricretes is high but it is lower for other applications. ESA

N87-11326# Stockholm Univ. (Sweden). Remote Sensing Lab.
REFLECTANCE PROPERTIES OF BARLEY FOR DIFFERENT AGRONOMICAL TREATMENTS
J. Kleman and E. Fagerland *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 491-494 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The relationship between the agronomical treatment of a crop and its reflectance properties was studied. Field measurements were carried out with a spectroradiometer covering the wavelength range 0.4 to 2.3 microns. Plots of barley (Hordeum distichum L.) were treated with different amounts of irrigation and fertilization. Reflectance factors in selected wavelength bands, ratios of reflectance factors, and color coordinates were analyzed regarding their temporal variations and their relations to biomass, water content on the crop, and grain yield. A blue color coordinate was found to be strongly related to the irrigation differences, but relatively insensitive to the amount of biomass. The information content in the 1.3 to 2.3 micron wavelength range is discussed. ESA

N87-11327# Open Univ., Milton (England). Dept. of Earth Sciences.
AGE-DEPENDENT CHANGES IN THE SPECTRAL RESPONSE OF LAVA SURFACES DUE TO WEATHERING, GROWTH OF LICHEN AND SPREAD OF VASCULAR PLANTS
D. A. Rothery, R. H. Lefebvre (Grand Valley State Coll., Allendale, Mich.), and F. Bevis *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 495-498 Sponsored by UK Science and Engineering Research Council (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The Craters of the Moon (USA) basaltic lavas were studied using Landsat MSS imagery. The appearance of pahoehoe flows with Blue Dragon crusts changes systematically with age. In situ measurements of the bidirectional reflectance factor of natural rock surfaces in the area shows that the aging of the remotely sensed spectral response is a combination of physicochemical changes in the rock surface, colonization of the surface by lichen, with percentage cover and species diversity increasing with age (these effects cause little further change after 8000 yr) and development of vascular plant cover (causing progressive change beyond 8000 yr). ESA

N87-11328# Chiba Univ. (Japan). Faculty of Engineering.
NUTRITIONAL DIAGNOSIS FOR PLANT BY FIELD SPECTRORADIOMETER
G. Saito, Y. Emori, Y. Yasuda, and M. Fukuhara *In* ESA of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 499-502 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The spectral reflectances of sugar beets during growth were measured with a hand held spectroradiometer. Correlations between the spectral reflectances and contents of nitrogen, phosphorus, and potassium of the plants were examined. The plants were grown in 12 treatments of fertilizer in 3 soil types. The relation between green light crop reflectance and sugar concentration is shown. Percentage concentration of sugar increases linearly up to 18% in proportion to reflectance. With reflectance less than 22%, correlation factor is 0.82 and from measured reflectance, sugar concentration can be accurately estimated. The time at which the green light crop reflectances becomes greater than 25% is considered as an optimum harvesting time. ESA

N87-11329# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
DIGITAL COMBINATION OF SAR AND (MSS) OPTICAL DATA FOR IDENTIFICATION OF SPECTRAL SIGNATURES
M. Rast and F. Jascolla (Technische Univ., Munich (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 503-509 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

The intercorrelation between SIR-A SAR data and MSS optical data on the reflectance properties of different soil types and geological features in an arid test site was studied. Application of radar data necessitated the basic evaluation of its spectral information and the comparison with optical data because of the

higher signature information content in the SAR data set in order to better understand surface reflectance in a shorter wavelength, and to assess the combination of different remote sensing information sources in operational application. Gray value profiles of SIR-A data in the area of Lake Nasser (Egypt) were set against Landsat MSS data and compared with field mapped ground truth data. Image merging of data sets with strongly different signature contents is shown to improve analysis. ESA

N87-11330# Canada Centre for Remote Sensing, Ottawa (Ontario).
SPECTRAL MEASUREMENTS OF TREE DEFOLIATION
P. M. Teillat, D. G. Leckie, D. Ostaff, G. Fedosejves, and F. J. Ahern *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 511-516 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Ground-based measurements were acquired in New Brunswick and Nova Scotia to study the spectral reflectance properties of current year and cumulative tree defoliation due to spruce budworm. Spectral reflectances of individual balsam fir trees and other tree types were acquired from 4.4 to 2.4 micrometers by a spectrometer system on a truck. Spectral measurements of tree components, such as red needles, new shoots, year-old needles, multiyear needles; twigs, bark, and lichen were made from 0.4 to 1.1 micrometers with a spectrometer and integrating sphere. The resulting data sets are described and the difficult logistics and constraints of tree spectroscopy are discussed. Analyses of these data should help to provide a sufficient understanding of the spectral properties of budworm defoliation to specify pertinent sensor bands for aircraft survey experiments. ESA

N87-11331# Institut Francais du Petrole, Rueil-Malmaison. Div. Geophysique et Instrumentation.
CONTRIBUTION OF INTERNAL WAVES TO SPECTRAL SIGNATURES [CONTRIBUTION A LA SIGNATURE SPECTRALE DES ONDES INTERNES]
A. Wadsworth and P. Piau *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 517-521 In FRENCH; ENGLISH summary (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Examples of internal wave visualizations from different sensors of the visible and microwave spectrum are shown and their radiometric characteristics are assessed. It is demonstrated that detection is not enhanced with a better geometric resolution and that the real aperture mode of the side-looking imaging radar is well suited for detection and identification of internal wave packets. The high accessibility of a given zone, using SPOT data and the good all-weather detection possibilities of ERS-1 are mentioned. ESA

N87-11332# Stockholm Univ. (Sweden). Dept. of Physical Geography.
LABORATORY MEASUREMENTS OF SPECTRAL REFLECTANCE (0.4 TO 2.3 MICRON) OF BASALTS
K. Wester and B. Lunden *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 523-526 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Age effects on the spectral reflectance of basalts from Iceland measured in the laboratory using a spectroradiometer, and weathered (with and without lichen) and cut rock surfaces were studied. Most of the lichen-free basalts are spectrally featureless. Reflectances are very low. Comparisons between weathered basalts indicate that the older the basalt the higher the reflectance, especially between 0.95 and 2.3 microns. The results also show that the general effect of lichen cover on basalt is to increase the reflectance. The lichen-covered basalts display absorption bands at 0.7 microns (chlorophyll), at 1.4 and 1.9 microns (water). Absorption bands near 1.7 and 2.1 microns are also present. ESA

N87-11333# Academia Sinica, Guiyang (China). Inst. of Geochemistry.
SPECTRAL FEATURES OF ROCKS AND MINERALS FROM BEIYUNOBO REGION AND METALLOGENETIC FORECAST FOR REE IN THE CENTRAL PART OF INNER MONGOLIA
Xuan Ding, Chang-he Ma, and Lai-zhi Gao *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 527-530 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

Reflection spectra of 150 samples of rocks and minerals were determined by spectrophotometer. Results show that the spectra of REE minerals display absorption bands at 0.79, 0,74, and 0.57 microns in order of increasing intensity; Fe-REE and dolomite-REE ores also show visual spectral features at 0.79, and 0,74 microns. Dolomites display an intense absorption feature near 2.35 microns. Because they contain more silica (average 20%) and dark color, limestones do not display the diagnostic band of carbonate at 2.35 microns. The spectral features near 0.74, 0.79, and 2.35 microns can be used as indicators of the REE deposits of Beiyunobo-type in the central part of Nei Mongol. ESA

N87-11334# Valencia Univ. (Spain). Dept. of Thermology.
LANDSAT-5 TM APPLICATION TO THE STUDY OF MODIFICATION OF SPECTRAL SIGNATURES OF CITRIC ORCHARDS AFFECTED BY FROSTS
V. Caselles, S. Gandia, and J. Melia *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 531-534 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

A study of the bidirectional reflectance of citrics given by Landsat 5 was used to evaluate the intensity of strong frost on the Spanish Mediterranean coast in January 1985. Bands 4 and 3 are more useful for monitoring the effects of the cold. The normalized difference index of vegetation calculated from these bands is used to evaluate the zones most influenced (of the order of 55% of the identified citrus orchards). ESA

N87-11335*# National Aeronautics and Space Administration, Washington, D.C.
NASA SCANNER PRODUCES COMPLETE IMAGE OF NORTH ATLANTIC OCEAN
Leon N. Perry 17 Oct. 1986 2 p
(NASA-News-Rel-86-147) Avail: NTIS HC A02/MF A01 CSCL 08B

Using NASA's coastal zone color scanner on the Nimbus-7 satellite, scientists recently completed a computer-generated color image showing, for the first time, the distribution of microscopic plant life, or phytoplankton, in the surface waters of the entire north Atlantic Ocean. The image also shows the land vegetation index for the continents bordering the north Atlantic basin, making the image the first to show measurements of both land and ocean plant abundance on such a large scale. The scanner measured sunlight reflected from the sea surface at five wavelengths to determine ocean color. Data was transmitted to receiving stations at various locations around the Earth. Although the scanner was designed to collect measurements primarily over coastal waters, the image of the north Atlantic Ocean was generated by merging many individual orbits of scanner data to form a composite image representing average conditions in May. The land vegetation index was acquired from observations by the satellite sensor called the advanced very high resolution radiometer onboard the NOAA-6 satellite, launched in June, 1979. Dark green in the image represents high density vegetation. Author

N87-11336*# California Univ., Davis. Dept. of Electrical and Computer Engineering.
LANDSAT D THEMATIC MAPPER IMAGE DIMENSIONALITY REDUCTION AND GEOMETRIC CORRECTION ACCURACY Final Report
Gary E. Ford 1986 111 p

(Contract NAS5-27577)
(NASA-CR-179876; NAS 1.26:179876) Avail: NTIS HC A06/MF A01 CSCL 05B

To characterize and quantify the performance of the Landsat thematic mapper (TM), techniques for dimensionality reduction by linear transformation have been studied and evaluated and the accuracy of the correction of geometric errors in TM images analyzed. Theoretical evaluations and comparisons for existing methods for the design of linear transformation for dimensionality reduction are presented. These methods include the discrete Karhunen Loeve (KL) expansion, Multiple Discriminant Analysis (MDA), Thematic Mapper (TM)-Tasseled Cap Linear Transformation and Singular Value Decomposition (SVD). A unified approach to these design problems is presented in which each method involves optimizing an objective function with respect to the linear transformation matrix. From these studies, four modified methods are proposed. They are referred to as the Space Variant Linear Transformation, the KL Transform-MDA hybrid method, and the First and Second Version of the Weighted MDA method. The modifications involve the assignment of weights to classes to achieve improvements in the class conditional probability of error for classes with high weights. Experimental evaluations of the existing and proposed methods have been performed using the six reflective bands of the TM data. It is shown that in terms of probability of classification error and the percentage of the cumulative eigenvalues, the six reflective bands of the TM data require only a three dimensional feature space. It is shown experimentally as well that for the proposed methods, the classes with high weights have improvements in class conditional probability of error estimates as expected. Author

N87-11337# South Carolina Univ., Columbia. Dept. of Geography.
FEASIBILITY STUDY OF WOOD STORK FORAGING HABITAT MAPPING USING LANDSAT MULTISPECTRAL DATA
J. R. Jensen, M. E. Hodgson, M. Coulter, and H. E. Mackey, Jr. 1986 19 p Presented at the Freshwater Wetlands and Wildlife Symposium, Charleston, S.C., 24 Mar. 1986 Prepared in cooperation with Du Pont de Nemours (E.I.) and Co., Aiken, S.C.
(Contract DE-AC09-76SR-00001)
(DE86-008904; DP-MS-85-119; CONF-8603101-2) Avail: NTIS HC A02/MF A01

The wood stork is a large wading bird which forages in shallow wetlands up to 70 kilometers from the colony. LANDSAT data were evaluated to determine if remote sensing data were suitable for locating and estimating the extent of potential foraging habitat for this species over such a large range. Thematic Mapper data of north-central Georgia and the Savannah River floodplain in South Carolina were obtained May 5, 1984. Spectral signatures from known foraging sites near a colony in Georgia were identified. Computer clustering techniques were used to identify and map shallow water and marsh wetland foraging habitats. Foraging acreages were computed, and maps of the locations of candidate foraging sites were produced for a 1520-square-kilometer area. Remote sensing appears to provide a feasible method of evaluating the regional wetland foraging habitat available to this wide-ranging species. DOE

N87-11338# Sandia National Labs., Albuquerque, N. Mex.
FY 1984 AND FY 1985 GEOCHEMISTRY AND MATERIALS STUDIES IN SUPPORT OF THE MAGMA ENERGY EXTRACTION PROGRAM
H. R. Westrich, L. J. Weirick, R. T. Cygan, M. Reece, P. F. Hlava, H. W. Stockman, and T. M. Gerlach Apr. 1986 66 p
(Contract DE-AC04-76DP-00789)
(DE86-009558; SAND-85-2843) Avail: NTIS HC A04/MF A01

Geochemistry and materials studies are being performed in support of the Magma Energy Extraction Program. The work is largely restricted to: (1) characterizing magmatic environments at sites of interest, (2) testing engineering materials in laboratory simulated magmatic environments, (3) investigating chemical mass transport effects inherent in designs for direct contact heat exchangers, and (4) evaluating degassing hazards associated with drilling into and extracting energy from shallow magma. Magma characterization studies have been completed for shallow magma at Long Valley, Coso volcanic field, and Kilauea volcano. The behavior of 17 commercially available materials has been examined in rhyolite magma at 850(0)C and 200 MPa for periods up to seven days. Analysis of reaction products from materials tests to date indicate that oxidation is the main corrosion problem for most alloys in rhyolitic magma. Considerations of corrosion resistance, high-temperature strength, and cost indicate nickel-base superalloys offer the most promise as candidates for use in rhyolitic magma. DOE

N87-11339# Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).
TRAVEL REPORT OF A VISIT TO THE UNITED STATES FROM 17 AUGUST TO 31 AUGUST 1985 [REISVERSLAG VAN EEN BEZOEK AAN DE VERENIGDE STATEN VAN 17 TOT 31 AUGUSTUS 1985]
G. J. A. Nieuwenhuis and J. M. M. Bouwmans Nov. 1985 22 p In DUTCH and ENGLISH
(ICW-1659; ETN-86-98061) Avail: NTIS HC A02/MF A01

Organizational aspects, papers and posters, and conclusions of the International Workshop on Hydrologic Applications of Space Technology are discussed. A course on geographic information systems is presented. The status of remote sensing research in the US is outlined. ESA

N87-11340# Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).
REMOTE SENSING IN HYDROLOGY [DE HYDROLOGIE OP AFSTAND IN BEELD GEBRACHT]
G. J. A. Nieuwenhuis Jan. 1986 18 p In DUTCH
(ICW-1687; ETN-86-98062) Avail: NTIS HC A02/MF A01

Applications of remote sensing techniques are presented. Aerial remote sensing systems are surveyed. The difference between aircraft and satellite remote sensing is discussed. In order to illustrate that electronic aerial sensing techniques lend themselves well to quantitative analysis, results showing the mapping of evaporation using digital reflection and heat images are quoted. Applications of remote sensing in hydrology and agricultural water economy are described. ESA

N87-11341# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
SNOW STUDIES: STUDY JOURNEY TO SWITZERLAND, JANUARY 1986
Lennart Holm, Jan Kjellgren, and Ain Sume Mar. 1986 30 p In SWEDISH; ENGLISH summary Sponsored by Swedish Material Administration of the Armed Forces
(FOA-C-30419-E1,E3; ISSN-0347-3706; ETN-86-98332) Avail: NTIS HC A03/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR 50

Methods and instruments used for snow investigations and results from measurements are described. The methods are based on direct investigation of the snow cover, on remote sensing, and on resonant frequencies measurement. An instrument for field measurement of the dielectric constant connected with the moisture content of the snow, is reported. Reflectance values in a coaxial circuit, as function of the permittivity are mentioned. ESA

N87-11462 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SATELLITE MEASUREMENTS OF THE CLOUDINESS AND THE GLOBAL RADIATION FOR GLOBAL STATISTICS [SATELLITENMESSUNGEN DER BEWOELKING UND GLOBALSTRAHLUNG FUER EINE GLOBALE STATISTIK]
E. Raschke, F. Diekmann, A. Gratzki, J. Jacobs, M. Rieland, and H. J. Lutz *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 224-227 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11055*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Tracking Systems and Applications Section.
DEMONSTRATION OF THE FIDUCIAL CONCEPT USING DATA FROM THE MARCH 1985 GPS FIELD TEST
J. M. Davidson, C. L. Thornton, S. A. Stephens, S.-C. Wu, S. M. Lichten, J. S. Border, O. J. Sovers, T. H. Dixon, and B. G. Williams *In its* The Telecommunications and Data Acquisition Report (date] p 301 - 306 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03A

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N87-11342 Technische Hogeschool Twente, Enschede (Netherlands). Vakgroep Ontwikkelingskunde.
IMPLEMENTATION OF WINDMILLS IN GUJARAT, INDIA
Floris Blankenberg Apr. 1984 74 p
(ETN-86-97720; WP-1) Avail: Issuing Activity

The reasons for failure of implementation of development projects in Third World countries are analyzed through a case study of windmills in India. It is argued that there is no continuity in project planning, there is no attention paid to future developments, the feasibility of the option is not established, the project does not offer a package of facilities, the organizational structure is not considered properly, and the lower level organizations and institutions are not involved. ESA

N87-11343*# Hughes Aircraft Co., Newport Beach, Calif. Solid State Products Div.
SOLAR POWERED HYBRID SENSOR MODULE PROGRAM
J. M. Johnson and H. K. Holmes Mar. 1985 32 p
(Contract NAS1-17179)
(NASA-CR-172495; NAS 1.26:172495) Avail: NTIS HC A03/MF A01 CSCL 10A

Geo-orbital systems of the near future will require more sophisticated electronic and electromechanical monitoring and control systems than current satellite systems with an emphasis in the design on the electronic density and autonomy of the subsystem components. Results of a project to develop, design, and implement a proof-of-concept sensor system for space applications, with hybrids forming the active subsystem components are described. The design of the solar power hybrid sensor modules is discussed. Module construction and function are described. These modules combined low power CMOS electronics, GaAs solar cells, a crystal oscillatory standard UART data formatting, and a bidirectional optical data link into a single 1.25 x 1.25 x 0.25 inch hybrid package which has no need for electrical input or output. Several modules were built and tested. Applications of such a system for future space missions are also discussed.
Author

N87-11344*# Engelhard Corp., Edison, N.J. Research and Development Dept.
DEVELOP AND TEST FUEL CELL POWERED ON SITE INTEGRATED TOTAL ENERGY SYSTEMS. PHASE 3: FULL-SCALE POWER PLANT DEVELOPMENT Quarterly Report, Nov. 1985 - Jan. 1986
A. Kaufman, B. Olson, S. Pudick, C. L. Wang, J. Werth, and J. A. Whelan 17 Mar. 1986 20 p
(Contract DEN3-241)
(NASA-CR-175118; DOE/NASA-0241-21; NAS 1.26:175118; QR-19) Avail: NTIS HC A02/MF A01 CSCL 10A

The third in a series of 4kW stacks, consisting of 24 cells of the 13 inch x 23 inch cell size, has been on test for about 1600 hours. This stack is similar to the first two stacks, which ran 7000 and 8400 hours, respectively. The present stack incorporates technology improvements relating to the electrolyte-matrix, the current-collector assembly, and a reduction in the number of cooling plates. Performance is currently averaging about 0.64 per cell at 161 mA sq cm. Author

N87-11345*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPONENT TESTING OF A GROUND BASED GAS TURBINE STEAM COOLED RICH-BURN PRIMARY ZONE COMBUSTOR FOR EMISSIONS CONTROL OF NITROGENEOUS FUELS Final Report
Donald F. Schultz 1986 21 p Presented at the Inter-Agency Advanced Power Group, Washington, D.C., 15-16 Oct. 1986
(NASA-TM-88873; DOE/NASA/-13111/16; E-3280; NAS 1.15:88873) Avail: NTIS HC A02/MF A01 CSCL 10A

This effort summarizes the work performed on a steam cooled, rich-burn primary zone, variable geometry combustor designed for combustion of nitrogeneous fuels such as heavy oils or synthetic crude oils. The steam cooling was employed to determine its feasibility and assess its usefulness as part of a ground based gas turbine bottoming cycle. Variable combustor geometry was employed to demonstrate its ability to control primary and secondary zone equivalence ratios and overall pressure drop. Both concepts proved to be highly successful in achieving their desired objectives. The steam cooling reduced peak liner temperatures to less than 800 K. This low temperature offers the potential of both long life and reduced use of strategic materials for liner fabrication. These degrees of variable geometry were successfully employed to control air flow distribution within the combustor. A variable blade angle axial flow air swirler was used to control primary zone air flow, while the secondary and tertiary zone air flows were controlled by rotating bands which regulated air flow to the secondary zone quench holes and the dilutions holes respectively. Author

N87-11346*# Engelhard Corp., Edison, N.J. Research and Development Dept.
DEVELOP AND TEST FUEL CELL POWERED ON-SITE INTEGRATED TOTAL ENERGY SYSTEMS. PHASE 3: FULL-SCALE POWER PLANT DEVELOPMENT Quarterly Report, Aug. - Oct. 1985
A. Kaufman, B. Olson, S. Pudick, C. L. Wang, J. Werth, and J. A. Whelan 3 Feb. 1986 22 p
(Contract DEN3-241)
(NASA-CR-175117; DOE/NASA-0241/20; NAS 1.26:175117; QR-18) Avail: NTIS HC A02/MF A01 CSCL 10A

The testing of two 25-cell stacks of the 13 inch x 23 inch cell size (about 4kW) was carried out for 7000 and 8400 hours, respectively. A 25kW stack containing 175 cells of the same size and based on the same technology was constructed and is on test. A third 4kW stack, which will contain 24 cells, will comprise several new technology features; these will be assesed for performance and durability in long-term testing. Author

N87-11347*# Engelhard Corp., Edison, N.J. Research and Development Dept.
DEVELOP AND TEST FUEL CELL POWERED ON SITE INTEGRATED TOTAL ENERGY SYSEMS: PHASE 3: FULL-SCALE POWER PLANT DEVELOPMENT Quarterly Report, May - Jul. 1985
A. Kaufman, B. Olson, S. Pudick, C. L. Wang, J. Werth, and J. A. Whelan 9 Oct. 1986 23 p
(Contract DEN3-241)
(NASA-CR-175075; DOE/NASA-0241/19; NAS 1.26:175075; QR-17) Avail: NTIS HC A02/MF A01 CSCL 10A

A 25-cell stack of the 13 inch x 23 inch cell size (about 4kW) remains on test after 8300 hours, using simulated reformate fuel. A similar stack was previously shut down after 7000 hours on load. These tests have been carried out for the purpose of assessing the durability of fuel cell stack components developed through the end of 1983. A 25kW stack containing 175 cells of

the same size and utilizing a technology base representative of the 25-cell stacks has been constructed and is undergoing initial testing. A third 4kW stack is being prepared, and this stack will incorporate several new technology features. Author

N87-11348*# Paragon Pacific, Inc., El Segundo, Calif.
WEST-3 WIND TURBINE SIMULATOR DEVELOPMENT. VOLUME 1: SUMMARY Final Report
S. Sridhar Jul. 1985 24 p
(Contracts DEN3-247; DE-AI01-76ET-20320)
(NASA-CR-174981; DOE/NASA-0247/1-Vol-1; NAS 1.26:174981; PPI-FID-300101-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 10A

This report is a summary description of WEST-3, a new real-time wind turbine simulator developed by Paragon Pacific Inc. WEST-3 is an all digital, fully programmable, high performance parallel processing computer. Contained in the report are descriptions of the WEST-3 hardware and software. WEST-3 consists of a network of Computational Units (CUs) working in parallel. Each CU is a custom designed high speed digital processor operating independently of other CUs. The CU, which is the main building block of the system, is described in some detail. A major contributor to the high performance of the system is the use a unique method for transferring data among the CUs. The software aspects of WEST-3 covered in the report include the preparation of the simulation model (reformulation, scaling and normalization), and the use of the system software (Translator, Linker, Assembler and Loader). Also given is a description of the wind turbine simulation model used in WEST-3, and some sample results from a study conducted to validate the system. Finally, efforts currently underway to enhance the user friendliness of the system are outlined; these include the 32-bit floating point capability, and major improvements in system software. Author

N87-11349# Army Military Personnel Center, Alexandria, Va.
EVALUATION OF IMPROVEMENTS TO BRAYTON CYCLE PERFORMANCE Final Report
Michael A. Spasyk 29 May 1986 121 p
(AD-A169018) Avail: NTIS HC A06/MF A01 CSCL 10/2

This study addresses the problem of finding an energy conversion method to take advantage of the high maximum cycle temperatures achieved with solar central receivers. Most current practice is to use steam-based heat engines with solar receivers but these Rankine cycles cannot operate at the higher possible temperatures. Derivatives of gas-based Brayton cycles are considered to take advantage of the expected increased cycle performance of higher temperatures. Computer modeling was done to examine the effect of maximum temperature on efficiency of two Brayton cycle derivatives and a simple Brayton cycle (GT). The modified Brayton cycles include a combination of intercooling, regeneration, and reheat (IGT) and a Brayton cycle with steam injection (STIG). The turbine inlet temperature, the steam-to-air injection mass ratio (for the STIG), and the compression pressure ratios were treated as parameters in the analysis. Both First Law and Second Law efficiencies were examined. Efficiencies were highest for the IGT followed by the STIG and GT, respectively. Considerable improvements in specific work output were demonstrated by the STIG over both the IGT and GT systems. First and Second law analyses show a gradual increase of efficiency with turbine inlet temperature with diminishing returns at higher temperatures. GRA

N87-11350# Spire Corp., Bedford, Mass.
INVESTIGATION OF HIGH-EFFICIENCY SILICON CONCENTRATOR CELLS
Apr. 1986 130 p
(Contract DE-AC04-76DP-00789)
(DE86-011914; SAND-85-7023) Avail: NTIS HC A07/MF A01

The high-efficiency features of silicon concentrator cells examined include reduction of heavy-doping effects through ion implantation, surface passivation, reduction of cell thickness, patterning to reduce emitter area, passivation to reduce metal/Si contact interaction area, and investigation of back junction solar cells to separate emitter patterning from grid design. This research has achieved V sub OC of 657 mV. Concentrator cell efficiency of up to 20.7% was also attained. The principal finding of this work is that thin high-efficiency designs must have adequate passivation on the front and back surfaces. Lack of passivation at the metal/Si contact interface has emerged as the limiting feature of the best cells. DOE

N87-11351# Varian Associates, Palo Alto, Calif.
FABRICATING HIGH-CONCENTRATION GaAs CELL PHOTOVOLTAIC MODULES
N. R. Kaminar and H. C. Hamaker Apr. 1986 62 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-011705; SAND-85-7021) Avail: NTIS HC A04/MF A01

This program comprises the design and manufacture of components of a GaAs-cell, passively-cooled concentrator. A Fresnel lens, 5.44-inches square, was used in conjunction with a solid glass, domed-top secondary optical element to concentrate the light on single-junction GaAs cells. The cell had an active area 0.2 inches in diameter and was soldered directly to the copper heatspreader. The heatspreader was bonded with heat-conductive RTV to an aluminum dissipator, which formed the module housing. The module was designed to be attached to a tracker at the center. Obtained were 26% cell efficiency in flash tests and 19.2% combined lens/cell efficiency outdoors. Optical transmission was lower than expected due to higher than expected losses in the secondary. The secondaries were made using a molding technique applicable to mass production. DOE

N87-11352# British Aerospace Dynamics Group, Bristol (England). Space and Communications Div.
HPSA: HIGH POWER SOLAR ARRAY STUDY Final Report
C. P. Lee Paris ESA Jul. 1985 156 p
(Contract ESA-6064/84-NL-PB)
(BAe-TP-8071; HPSA/RPT/8071; ESA-CR(P)-2201; ETN-86-98086) Avail: NTIS HC A08/MF A01

A 30 kW solar array design for ESA's Columbus program was established. Realistic array requirements were identified using the ESA recommended designed reference mission. System and subsystem level studies lead to preferred design solutions for silicon and gallium arsenide cell technologies. A development philosophy and test plan to pursue the identification of critical aspects was derived and a preliminary cost appraisal was made. It is concluded that a planar double roll out array employing silicon cells represents the most attractive solution, with a gallium arsenide roll out as a logical derivative. ESA

N87-10925# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Group.
INFLUENCE OF FIBER ORIENTATION AND BOUNDARY CONDITIONS ON THE DYNAMIC BEHAVIOR OF A CYLINDRICALLY TELESCOPING SOLAR ARRAY (INTELSAT 6)
E. D. Sach, H. J. Huettmann, and E. Fritsche *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 289-292 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N87-11353*# Old Dominion Univ., Norfolk, Va. Dept. of Chemical Sciences.
COMPUTATIONAL SOLUTION OF ATMOSPHERIC CHEMISTRY PROBLEMS Final Report, period ending 31 Dec. 1985
Jawed Jafri and Robert L. Ake Aug. 1986 80 p
(Grant NSG-1393)
(NASA-CR-179803; NAS 1.26:179803) Avail: NTIS HC A05/MF A01 CSCL 13B

Extensive studies were performed on problems of interest in atmospheric chemistry. In addition to several minor projects, four major projects were performed and described (theoretical studies

of ground and low-lying excited states of ClO2; ground and excited state potential energy surfaces of the methyl peroxy radical; electronic states ot the FO radical; and theoretical studies S02 (H2O) (sub n)). Author

N87-11354# Royal Netherlands Meteorological Inst., De Bilt.
DRY DEPOSITION PARAMETERIZATION IN LONG RANGE TRANSPORT MODELS
A. Kulig 1986 39 p Sponsored by UNESCO, Paris, France, and the Royal Netherlands Meteorological Institute, De Bilt, Netherlands
(KNMI-WR-86-1; B8666193; ISSN-0169-1651; ETN-86-98501) Avail: NTIS HC A03/MF A01

Methods for the computation of surface deposition velocities of sulfur and nitrogen dioxide, and sulfate and nitrate particles are derived. The methods may be used in studies of long range (mesoscale and regional scale) pollution transport. The influence of friction velocity and stability of the atmosphere on aerodynamic resistance is discussed. The standard deposition velocities which consist of the surface resistance and resistance of the laminar sublayer adjacent to the surface, are estimated. Mean values of dry deposition velocities for terrain categories useful in long range transport models are proposed. ESA

N87-11370 Deutscher Wetterdienst, Offenbach am Main (West Germany).
LONG RANGE ATMOSPHERIC TRANSPORT OF ANTHROPOGENIC AEROSOLS IN AND THROUGH THE ARCTIC [ATMOSPHAERISCHER FERNTRANSPORT VON ANTHROPOGENEN AEROSOLEN IN UND DURCH DIE ARKTIS]
Wolfgang E. Raatz *In its* Reports of Meteorology, no. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 9-10 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11428 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische.
A STATISTICAL METHOD FOR PREDICTION OF POLLUTANT EMISSION [EINE STATISTISCHE METHODE ZUR IMMISSIONSPROGNOSE]
Detlef Carius *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 152-153 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11430 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
NUMERICAL SIMULATION OF THE TURBULENT DIFFUSION ABOVE A ROUGH TERRAIN [NUMERISCHE SIMULATION TURBULENTER DIFFUSION UEBER UNEBENEM GELAENDE]
Michael Wamser and Hans-Dieter Haenel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 156-157 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11432 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
DISPERSION OF ACCIDENTALLY RELEASED HEAVY GASES [AUSBREITUNG STOERFALLARTIG FREIGESETZTER SCHWERER GASE]
Gert Koenig and Michael Schatzmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 160-161 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11450 Deutscher Wetterdienst, Offenbach am Main (West Germany).
INCREASE OF THE DUST MASS CONTENT IN THE AIR OF HAMBURG (WEST GERMANY) [ANSTIEG DES STAUBMASSENGEHALTS DER LUFT IN HAMBURG]
U. Kaminski and P. Winkler *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 198-199 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11451 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
NUMERICAL SIMULATION OF PHOTOSMOG IN A DYNAMIC-KINETIC MODEL OF THE ATMOSPHERIC BOUNDARY LAYER [NUMERISCHE SIMULATION VON PHOTOSMOG IN EINEM DYNAMISCHE-KINETISCHEN MODELL DER ATMOSPHAERISCHEN GRENZSCHICHT]
G. Kramm and F. Herbert *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and our Environment 1986 p 200-201 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N87-11355 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE CURRENT SYSTEM GENERATED BY THE PORCUPINE ARTIFICIAL ION BEAM IN THE IONOSPHERIC BACKGROUND PLASMA
R. Z. Sagdeev, V. N. Oraevsky, E. V. Mishin, V. Ya. Kapitanov, V. G. Korobeinikov, Yu. Ya. Ruzhin, V. A. Rozhansky, O. H. Bauer, G. Haerendel, and R. A. Treumann Mar. 1986 16 p Presented at 26th COSPAR General Assembly, Toulouse, France, 1986 Sponsored in part by DFVLR
(Contracts BMFT-01-D0074A; BMFT-RV14B7/74)
(MPE-Preprint-49; ETN-86-98210) Copyright. Avail: Issuing Activity

The injection of a heavy ion beam into the magnetized ionospheric plasma during the PORCUPINE experiment showed that the beam is electrically depolarized while the electric current is attenuated by only 10%. This stresses the importance role of the ambient ionospheric plasma background and raises the question of how the beam current closes. A theoretical model for the development of the current system in the background plasma, based on the assumption of short-circuiting the current along the magnetic lines of force is presented. The model is supported by the experimental data of PORCUPINE. Results also suggest that plasma turbulence in the ion cyclotron modes is important in producing the anomalous resistivities required. ESA

N87-11356 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DISCOVERY OF ENERGETIC MOLECULAR IONS (NO+ AND O2+) IN THE STORM TIME RING CURRENT
B. Klecker, E. Moebius, D. Hovestadt, M. Scholer, G. Gloeckler (Maryland Univ., College Park.), and F. M. Ipavich Jun. 1986 15 p Submitted for publication
(MPE-Preprint-53; ASP-55; ETN-86-98213) Avail: Issuing Activity

A few hours after the onset of a large geomagnetic storm, energetic molecular ions in the mass range 28 to 32, predominantly NO(+) and O2(+), were discovered in the outer ring current at L = 7. The data were obtained with the time-of-flight spectrometer SULEICA on the AMPTE/IRM spacecraft. At 160 keV/e mean abundance ratio of the molecular ions relative to O(+) ions is 0.031+0.004. During quiet times no molecular ions are observed, the 1 sigma upper limit of the ratio derived by averaging over

several quiet periods is 0.003. The observations demonstrate the injection of ionospheric plasma into the storm time ring current and the subsequent acceleration to energies of several hundred keV on a time scale of a few hours after the onset of the magnetic storm. ESA

N87-11357# National Academy of Sciences - National Research Council, Washington, D. C. Geophysics Study Committee.
ACTIVE TECTONICS: PART 2: EPEIROGENIC AND INTRA-PLATE MOVEMENTS
Larry D. Brown (Cornell Univ., Ithaca, N.Y.) and Robert E. Reilinger (Air Force Geophysics Lab., Hanscom AFB, Mass.) 1986 16 p Avail: NTIS HC A02/MF A01

The major deformations of the Earth's surface are largely consistent with the tenets of plate tectonics, which predict that such activity should be focused at the various boundaries along which massive lithospheric plates collide, pull apart, or slide past one another. Yet crustal deformations also occur well into the interior of these plates. Some may represent the distributed effects of distant plate boundaries, as, for example, the earthquakes of the intermontane western United States. Some, such as the geodetically observed uplift over a deep magma chamber in the Rio Grande rift of New Mexico, may correspond to incipient foundation of a new plate boundary. Others, like the subtle, broad uplifts and subsidences in the nominally stable cratonic interiors, are much more puzzling. Such motions often appear estranged, if not divorced, from accepted plate-tectonic processes. Postglacial rebound, a well-known phenomenon in portions of North America and Europe, also appears to be an inadequate explanation for many observations. Understanding contemporary motions of plate interiors is often hindered by the paucity and uncertain accuracy of relevant geophysical and geodetic observations. Yet intraplate tectonics constitutes more than a scientific enigma. Even seemingly slow vertical motions may threaten river courses or seafront properties on socially relevant time scales, and the subtle strain accumulating elsewhere may portend future earthquakes or volcanoes in the least predictable places. Author

N87-11358*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRBORNE LIDAR MEASUREMENTS OF EL CHICHON STRATOSPHERIC AEROSOLS, MAY 1983
M. Patrick McCormick and M. T. Osborn (SASC Technologies, Inc., Hampton, Va.) Oct. 1986 91 p
(NASA-RP-1172; L-16176; NAS 1.61:1172) Avail: NTIS HC A05/MF A01

An experimental survey flight to determine the spatial distribution and aerosol characteristics of the El Chichon-produced stratospheric aerosol was conducted in May 1983. The mission included several different sensors flown abroad the NASA Convair 990 at latitudes between 72 deg. and 56 deg. S. This report presents the lidar data from that flight mission. Representative profiles of lidar backscatter ratio, plots of integrated backscattering function versus latitude, and contours of backscatter mixing ratio versus altitude and latitude are given. In addition, tables containing numerical values of the backscatter ratio and backscattering function versus altitude are supplied for each profile. By May 1983, material produced by the El Chichon eruptions of late March-early April 1982 had spread throughout the latitudes covered by this mission. However, the most massive portion of the material resided north of 33 deg. N and was concentrared below 21 km. In this latitude region (33 deg. N to 72 deg. N), peak backscatter ratios at a wavelength of 0.6943 microns varied between 3.5 and 4.5, and the peak integratred backscattering function was about 18 X 10 to the -4 power/sr, corresponding to a peak optical depth calculated to be approximately 0.08. This report presents the results of this mission in a ready-to-use format for atmospheric and climatic studies. Author

N87-11359# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
COMPUTER SIMULATION OF THE DYNAMICS OF THE NEAR-EARTH PART OF THE GEOMAGNETIC TAIL Final Report, 1 Jan. 1983 - 4 May 1986
R. A. Wolf 5 May 1986 40 p
(Contract F19628-83-K-0016)
(AD-A169449; AFGL-TR-86-0063) Avail: NTIS HC A03/MF A01 CSCL 04/1

The objective of the contract was to extend the Rice Convection Modeling capabilities tailward to include the near Earth part of the geomagnetic tail, in order to include the dynamics of that region in our substorm simulations. The effort was divided into three parts: (1) development of equilibrium magnetic-field models; (2) development of an MHD code for use in the near magnetotail for periods when flows are supersonic or super-Alfvenic; and (3) modification of the Rice Convection Model to make it applicable further out in the magnetotail. GRA

N87-11360# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
DISTRIBUTION, LITHOLOGY AND AGES OF LATE CENOZOIC VOLCANISM ON THE EASTERN MARGIN OF THE GREAT BASIN, WEST-CENTRAL UTAH
W. P. Nash 1986 88 p
(Contract DE-AC07-79ID-12079)
(DE86-009898; DOE/ID-12079/131; ESL-86007-TR) Avail: NTIS HC A05/MF A01

The eastern margin of the Basin and Range province in central Utah is the locus of late Cenozoic volcanic activity and has witnessed several volcanic episodes within the last three million years. The Twin Peaks volcanic center became active 2.7 m.y. ago producing rhyodacite and rhyolite from a shallow silicic magma body accompanied by voluminous eruptions of basalt. Between about 1 and 0.3 m.y. ago there were eruptions of high silica rhyolite from a deep-seated magma source beneath the Mineral Mountains together with primitive and strongly fractionated mafic magmas of the Cove Fort subprovince. Within this volcanic area are two localities, Roosevelt Hot Springs and Sulfurdale, which have high temperature waters at or near the surface. To the north in the Black Rock Desert, volcanism extended from 1.5 m.y to only several hundred years ago. The activity was dominated by basaltic eruptions, but the area contains the youngest known rhyolite body in Utah (0.4 m.y.). Volcanic vents are located along major crustal discontinuities in the Black Rock Desert, along ring fracture systems at Twin Peaks, and are aligned along trends of north-south normal faulting in the Mineral Mountains and Cove Fort areas. DOE

N87-11361# Kiruna Geophysical Inst. (Sweden).
A NEW METHOD OF ORGANIZING SPECTRAL LINE INTENSITY RATIO FLUCTUATIONS OF NIGHTGLOW EMISSIONS
B. Thelin Feb. 1986 17 p Submitted for publication
(KGI-Preprint-087; ISSN-0349-2656; ETN-86-97849) Avail: NTIS HC A02/MF A01

A linearization effect between atmospheric night airglow emissions is presented. A linear graph was obtained for atomic spectral lines and vibrational band spectra when the spectral line intensity ratio fluctuations were plotted versus the photon energies of these emissions. To study this effect, data from photometer investigations of night airglow emissions at different times and places were used. Results show that the Thelin (1986) method of analyzing relative line intensity ratio fluctuations in optical emission spectroscopy of laboratory plasmas is also suitable for the nightglow emissions of the upper atmosphere. ESA

N87-11362# Kiruna Geophysical Inst. (Sweden).
A NEW METHOD OF ORGANIZING SPECTRAL LINE INTENSITY RATIO FLUCTUATIONS OF AURORAL EMISSIONS
B. Thelin Feb. 1986 28 p
(KGI-Preprint-089; ISSN-0349-2656; ETN-86-97851) Avail: NTIS HC A03/MF A01

A linearization effect between atmospheric auroral emissions is presented. The same kind of effect is also found in nightglow emissions from photometer measurements and in the spectrochemical field from studies of optical light sources. Linear graphs were obtained for atomic spectral lines and vibrational band spectra

when the spectral line ratio fluctuations were plotted versus the photon energies of these emissions. The effect was studied with a spectrophotometer in auroral emissions; linear graphs are obtained. The studies of auroral light reveal the importance of the inelastic scattering cross section between electrons-atoms and electrons-molecules. The mean energy of the interacting thermal electrons that are active in the different auroral phases can be determined. ESA

N87-11363# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
MODEL OF THE SOLAR RADIATION REFLECTED BY EARTH AND THE ATMOSPHERE BETWEEN 0.35 AND 4 MICRONS [MODELISATION DU RAYONNEMENT SOLAIRE REFLECHI PAR LATMOSPHERE ET LA TERRE ENTRE 0.35 ET 4 MICRONS]
P. Y. Deschamps, M. Herman, and D. Tanre Paris ESA Jan. 1983 178 p In FRENCH
(Contract ESA-4393/80-F-DD(SC))
(ESA-CR(P)-2254; ETN-86-98131) Avail: NTIS HC A09/MF A01

The optical phenomena produced by reflected infrared solar radiation are studied in order to formulate a model useful to satellite designers. The investigated problems include surface reflectance bands, gaseous absorption, and molecular and aerosol diffusion. A numerical model which represents the diffusion phenomena in a simple form and with high accuracy is presented, but the model's domain is restricted to weak concentrations of aerosols and it does not apply to clouds. Examples of satellite instrument corrections using the model are included. ESA

N87-11364# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 500, APRIL 1986. PART 2: (COMPREHENSIVE REPORTS). DATA FOR OCTOBER 1985 AND MISCELLANEA
H. E. Coffey, ed. Apr. 1986 36 p
(Contract N00014-86-F-0049)
(PB86-213873; SGD-500-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

The detailed index for 1985 to 1986, and the data for October 1985 (Meudon carte synoptique, solar flares, solar radio bursts at fixed frequencies, solar X-ray radiation from GOES satellite, mass ejections from the Sun, and active prominences and filaments) are given. GRA

N87-11365# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 500, APRIL 1986. PART 1: (PROMPT REPORTS). DATA FOR MARCH 1986, FEBRUARY 1986 AND LATE DATA
H. E. Coffey, ed. Mar. 1986 98 p
(Contract N00014-86-F-0049)
(PB86-213865; SGD-500-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 03B

The detailed index for 1985 to 1986; data for March 1986 (advance and worldwide IUWDS alert periods, solar activity indices, solar flares, solar radio emission, Vostok inferred interplanetary magnetic field polarity, Stanford mean solar magnetic field); data for February 1986 (solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, and radio propagation indices), and late data (cosmic ray measurements by neutron monitor January 1986, solar radio emission February 1986, geomagnetic indices, and calcium plage data) are given. GRA

N87-11366 Michigan Univ., Ann Arbor.
ESTIMATION OF SURFACE ALBEDO AND LIGHT ABSORPTION BY ATMOSPHERIC AEROSOLS UNDER CLEAR SKIES FROM DIGITISED GOES-EAST VISUAL IMAGES Ph.D. Thesis
James Robert Foreman 1986 242 p
Avail: Univ. Microfilms Order No. DA8612517

A method of estimating the Earth's surface albedo and the absorption of solar radiation by atmospheric aerosols from the energy balance with satellite visual images is discussed. A solution is proposed using the calibration of satellite imagery presented by Norton et al. (1980), the atmospheric corrections presented in Nack and Curran (1978) and the clear sky transmissivity model of Hoyt (1978). This method is tested on a set of data for twenty-three clear-sky cases in February, 1982 at the Hampton University Solar Measurement Site in Virginia. The albedos and aerosol light absorptions found are compared with various meteorological and illumination-viewing geometry variables, and the Hoyt (1978) model aerosol absorption predictions. The surface albedos showed a reasonable mean value of 0.177(+ or - 0.054) but showed no significant dependence on any of the parameters tested. They showed a positive dependence of the surface albedo on the solar zenith angle; however, that was low in significance but was in agreement with other work (e.g., Raschke et al., 1973). The aerosol absorptions show reasonable ensemble means in both direct and total solar radiation. Dissert. Abstr.

N87-11373 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
VERTICAL ENERGY FLUXES AND MERIDIONAL HEAT TRANSPORT IN THE NORTH ATLANTIC OCEAN [VERTIKALE ENERGIEFLUESSE UND MERIDIONALER WAERMETRANSPORT IM NORDATLANTIK]
H.-J. Isemer and L. Hasse *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 15-16 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11379 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
ACCURACY ANALYSIS OF SATELLITE EXPERIMENTS FOR THE MEASUREMENT OF THE RADIATION BUDGET [EINE GENAUIGEKEITSANALYSE VON SATELLITENEXPERIMENTEN ZUR MESSUNG DER STRAHLUNGSBILANZ]
Rolf Stuhlmann, Heinrich Knottenberg, Ehrhard Raschke, and Matthias Wiegner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 29-30 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04A

N87-11382 GKSS-Forschungszentrum Geesthacht (West Germany).
SUBGRID PARAMETERIZATION IN FLOWS WITH HELICITY [SUBGRID-PARAMETRISIERUNG IN STROEMUNGEN MIT HELIZITAET]
M. Lautenschlager, D. Eppel, and W. C. Thacker *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 36-37 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11383 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
MODELING OF RADIATION AND CLOUD CHARACTERISTICS FOR MODELS OF GENERAL CIRCULATION AND CLIMATE [UEBER DIE MODELLIERUNG VON STRAHLUNGS- UND WOLKENEIGENSCHAFTEN FUER MODELLE DER ALLGEMEINEN ZIRKULATION UND DES KLIMAS]
Burkhardt Rockel, Ehrhard Raschke, and Gaoxiang Zhao *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 38-39 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11385 Osnabrueck Univ. (West Germany). Inst. fuer Biologie/Chemie.
THE CARBON EXCHANGE BETWEEN ATMOSPHERE AND TERRESTRIAL BIOSPHERE [ZUM KOHLENSTOFFAUSTAUSCH ZWISCHEN ATMOSPHAERE UND TERRESTRISCHER BIOSPHAERE]
G. Esser *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference

on the Global Climate and Our Environment 1986 p 42-43 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11386 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.
THE CALCULATION OF THE FLOW RESISTANCE OF OROGRAPHIC OBSTACLES USING A MESOSCALE MODEL [STROEMUNGSWIDERSTAND OROGRAPHISCHER HINDERNISSE MIT EINEM MESOSKALIGEN MODELL BERECHNET]
Stefan Emeis and Franz Fiedler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 44-45 In GERMAN Sponsored by Deutschen Forschungsgemeinschaft (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11389 GKSS-Forschungszentrum Geesthacht (West Germany).
A COMPARISON OF SEVERAL MODELS FOR THE CALCULATION OF GROUND TEMPERATURE AND GROUND MOISTURE [EIN VERGLEICH VERSCHIEDENER MODELLE ZUR BERECHNUNG DER BODENTEMPERATUR UND BODENFEUCHTE]
Martin Clausen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 50-51 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11390 Deutscher Wetterdienst, Offenbach am Main (West Germany).
MEASUREMENT, CALCULATION, AND PARAMETERIZATION OF ATMOSPHERIC HEAT RADIATION [MESSUNG, BERECHNUNG UND PARAMETRISIERUNG DER ATMOSPHAERISCHEN WAERMESTRAHLUNG]
G. Czeplak *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 52-53 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11394 Alfred-Wegener-Inst. for Polar Research, Bremerhaven (West Germany).
PHYSICAL PROCESSES IN THE ATMOSPHERIC BOUNDARY LAYER AT THE PACK-ICE BORDER [PHYSIKALISCHE PROZESSE IN DER ATMOSPHAERISCHEN GRENZSCHICHT AM PACKEISRAND]
Christian Wamser and Guenter Kellner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 60-61 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11395 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie.
ATMOSPHERIC PROCESSES AT THE BOUNDARY OF THE ANTARCTIC CONTINENT [ATMOSPHAERISCHE PROZESSE AM RANDE DES ANTARKTISCHEN KONTINENTS]
Christoph Kottmeier, Hans-Juergen Belitz, and Hans-Ulrich Stuckenberg *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 62-63 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11399 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
INTERACTIVE COUPLING OF OCEANIC TOP LAYER MODELS AND ATMOSPHERIC CIRCULATION MODELS [INTERAKTIVE KOPPLUNG VON OZEANISCHEN DECKSCHICHTMODELLEN AN ATMOSPHAERISCHE ZIRKULATIONSMODELLE]
Joachim Biercamp *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 74-75 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11400 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
THE EFFECTS OF MOUNTAINS ON BLOCKING IN A CIRCULATION MODEL. CONSIDERATION OF THE ANGULAR MOMENTUM BALANCE [GEBIRGSEFFEKTE BEI BLOCKBILDUNGEN IN EINEM ZIRKULATIONSMODELL. BETRACHTUNG DER DREHIMPULSBILANZ]
Guenter Fischer *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 76-77 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11402 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
COUPLED OCEAN-ATMOSPHERE MODELS WITHOUT DRIFT OF THE PROGNOSTIC VARIABLES [GEKOPPELTE OZEAN-ATMOSPHAEREN-MODELLE OHNE DRIFT DER PROGNOSTISCHEN VARIABLEN]
Robert Sausen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 82-83 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11405 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
THE RESPONSE OF THE GLOBAL ATMOSPHERE TO THE EXTRAORDINARY EL NINO SEA SURFACE TEMPERATURE ANOMALY IN JANUARY 1983: SIMULATION [DIE ANTWORT DER GLOBALEN ATMOSPHAERE AUF DIE AUSSERGEWOEHNLICHE EL NINO MEERESOBERFLAECHENTEMPERATURANOMALIE IN JANUAR 1983: SIMULATION]
Hans vonStorch and Ulrich Cubasch *In* Deutscher Wetterdienst Reports of Meteorology No. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment 1986 p 92-93 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11406 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
THE RESPONSE OF THE TROPICAL ATMOSPHERE TO THE EXTRAORDINARY EL NINO SEA SURFACE TEMPERATURE ANOMALLY 1982-1983: OBSERVATION [DIE ANTWORT DER TROPISCHEN ATMOSPHAERE AUF DIE AUSSERGEWOEHNLICHE EL NINO MEERESOBERFLAECHENTEMPERATURANOMALIE 1982/83 - BEOBACHTUNG]
Hans vonStorch and Rolf Doberitz *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 94-95 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11408 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.
THE SIGNIFICANCE OF INITIALIZATION FOR THE UNSTEADY SIMULATION OF MESOSCALE FLOWS [DIE BEDEUTUNG DER INITIALISIERUNG FUER DIE INSTATIONAERE SIMULATION MESOSKALIGER STROEMUNGEN]
Gerhard Adrian *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 98-99 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11409 GKSS-Forschungszentrum Geesthacht (West Germany).
THE DYNAMIC BASIC STRUCTURE OF THE GEESTHACHT

(WEST GERMANY) MESOSCALE MODEL [DAS DYNAMISCHE GRUNDGERUEST DES GEESTHACHTER MESOSKALENMODELLS]
D. Eppel and H. Kapitza *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 100-101 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11412 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie.
SOLAR RADIATION TRANSPORT IN REALISTIC ATMOSPHERES WITH 3-DIMENSIONAL CLOUD FIELDS [SOLARER STRAHLUNGSTRANSPORT IN REALISTISCHEN ATMOSPHAEREN MIT DREIDIMENSIONALEN WOLKENFELDERN]
Thomas Trautmann and Wilford Zdunkowski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 106-107 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11416 Technische Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
PHENOMENOLOGY OF THE EVOLUTION OF LARGE-SCALE BOUNDARY LAYER STRUCTURES [PHAENOMENOLOGIE DER EVOLUTION GROSSRAEUMIGER GRENZSCHICHSTRUKTUREN]
Hans-Joachim Lange *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 119-120 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11417 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
NUMERICAL INVESTIGATION OF THE NONLINEAR DYNAMICS OF BOUNDARY LAYER ROLLS [NUMERISCHE UNTERSUCHUNGEN ZUR NICHTLINEAREN DYNAMIK VON GRENZCHICHTROLLEN]
Andreas Chlond *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 121-122 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11420 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalisches.
DESCRIPTION OF MATTER-RADIATION INTERACTIONS AS NONLINEAR IRREVERSIBLE PROCESSES [BESCHREIBUNG VON MATERIE-STRAHLUNG-WECHSELWIRKUNGEN ALS NICHT-LINEARE IRREVERSIBLE PROZESSE]
Ulrich Callies *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 131-132 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11422 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
INVESTIGATION OF THE APERIODIC BEHAVIOR OF THE SOUTHERN OSCILLATION USING METHODS OF NONLINEAR SYSTEMS ANALYSIS [UNTERSUCHUNG DES APERIODISCHEN VERHALTENS DER SOUTHERN OSCILLATION MIT METHODEN DER NICHTLINEAREN SYSTEMANALYSE]
Andreas Hense *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 135-136 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11435 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
THE INFLUENCE OF THE PLANETARY BOUNDARY LAYER ON THE VERTICAL STRUCTURE OF THE HORIZONTAL SIGHT UP TO A HEIGHT OF 300 M [DER EINFLUSS DER PLANETAREN GRENZCHICHT AUF DIE VERTIKALSTRUKTUR DER HORIZONTALSICHT BIS 300 M HOEHE]
Burkhard Pietzner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 166-167 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11440 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SMALL SCALE AND SHORT TERM VARIABILITY OF GLOBAL RADIATION IN THE FEDERAL REPUBLIC OF GERMANY [KLEINRAEUMIGE UND KURZZEITIGE VARIABILITAET DER GLOBALSTRAHLUNG IN DER BUNDESREPUBLIK DEUTSCHLAND]
H. D. Behr *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 176-177 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11446 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.
CANALIZATION OF THE ATMOSPHERIC FLOW THROUGH VALLEYS [KANALISIERUNG DER ATMOSPHAERISCHEN STROEMUNG DURCH TAELER]
Franz Fiedler and Stefan Emeis *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 190-191 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11449 Kiel Univ. (West Germany). Abteilung Maritime Meteorologie.
MEASUREMENTS IN THE GROUND LEVEL ATMOSPHERIC LAYER DURING THE EXPERIMENT PUKK [MESSUNGEN IN DER BODENNAHEN LUFTSCHICHT WAEHREND PUKK]
Gerd Hessler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 196-197 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11456 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
MODEL CALCULATIONS OF THE THERMALLY INDUCED MESOSCALE MOUNTAIN WIND CIRCULATION [MODELLRECHNUNGEN ZUR THERMISCH INDUZIERTEN MESOSKALIGEN GEBIRGSWINDZIRKULATION]
F. Somieski and H. Mannstein *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 212-213 In GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11457 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
ANALYSIS OF MESOSCALE TEMPERATURE AND TURBIDITY FIELD [ANALYSE VON MESOSKALIGEN TEMPERATUR- UND TRUEBUNGSFELDERN]
Thomas Viehoff *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 214-215 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11458 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.
OROGRAPHIC INFLUENCE ON REGIONAL FLOW CONDITIONS, THE EXAMPLE OF THE NEUWIEDER BASIN. NUMERICAL SIMULATIONS [OROGRAPHISCHE BEEINFLUSSUNG VON REGIONALEN STROEMUNGSVERHAELTNISSEN AM BEISPIEL DES NEUWIEDER BECKENS -NUMERISCHE SIMULATIONEN]
Bernhard Vogel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 216-217 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11459 Institute for Meteorology and Water Economy, Cracow (Poland). Inst. fuer Meteorologie und Wasserwirtschaft.
EVOLUTION OF SODAR ECHOES AS A CLIMATOLOGICAL CHARACTERISTIC OF THE BOUNDARY LAYER [VERLAEUFE VON SODAR-ECHOS ALS KLIMATOLOGISCHE CHARAKTERISTIK DER GRENZSCHICHT]
Jacek Walczewski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 218-219 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N87-11367 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS OF METEOROLOGY, NO. 23: PROCEEDINGS OF THE GERMAN METEOROLOGISTS' CONFERENCE ON THE GLOBAL CLIMATE AND OUR ENVIRONMENT [ANNALEN DER METEOROLOGIE, NR. 23: DEUTSCHE METEOROLOGEN-TAGUNG 1986 DAS GLOBALE KLIMA UND UNSERE UMWELT]
1986 239 p Partly in GERMAN and ENGLISH Conference held in Muenster, West Germany, 14-17 Apr. 1986
(ISBN-3-88148-226-1; ISSN-0072-4122; ETN-86-97831)
Copyright. Avail: Issuing Activity

Climatological research observations, climatological processes, and climate models are presented. Nonlinear evolution processes in the atmosphere are treated. Physical oceanography, meteorological environment protection, and aeronautical meteorology are discussed. For individual titles, see N87-11368 through N87-11462.

N87-11368 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
VARIATIONS OF THE WATER VAPOR CONTENT IN THE LOWER TROPOSPHERE BETWEEN 20 DEG N AND 20 DEG S DURING THE LAST 20 YEARS [VARIATIONEN DES WASSERDAMPFGEHALTES IN DER UNTEREN TROPOSPHAERE ZWISHEN 20 DEG N UND 20 DEG S WAEHREND DER LETZTEN 20 JAHRE]
K. H. Weber, A. Hense, R. Glowienka-Hense, and H. Flohn *In* Deutscher Wetterdienst, Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 5-6 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Estimations on a quasiglobal basis of the long term variations of the water vapor content in the free atmosphere are presented. The estimations were made on the basis of the trend of the annual mean of the mixing ratio (i.e. humidity), at 700 hPa and 500 nPa in 20 tropical radiosonde stations. The trend of the annual mean of the temperature of the 200/850 hPa layer was also determined. Comparison of the results of different types of radiosondes and of geographically distributed stations is used to determine if the trends are real. A positive trend of the mixing ratio during the last 20 yr is found: 0.6 g/kg (i.e., 10%) at 700 hPa and 0.3 g/kg (i.e., 20%) at 500 hPa. ESA

N87-11369 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
THE STATISTICAL ESTIMATION OF PURE AND EQUIVALENT CO2 SIGNALS IN CLIMATOLOGICAL TIME SERIES [DIE STATISTISCHE ABSCHAETZUNG DES REINEN UND AEQUIVALENTEN CO2-SIGNALS IN KLIMATOLOGISCHEN ZEITREIHEN]
Christian-Dietrich Schoenwiese *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 7-8 In GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Climatological models simulated the expected anthropogenic concentration increase of atmospheric trace gases, especially of CO2 and its greenhouse effect. The simulations were compared with statistical estimations based on observed climatological data and using a multiple regression model. The observed climatological parameters (mean annual values-time series) are the Northern Hemisphere temperature, sea surface temperatures, and global sea level fluctuations. Most of the model calculations are well verified by the regression calculations. ESA

N87-11370 Deutscher Wetterdienst, Offenbach am Main (West Germany).
LONG RANGE ATMOSPHERIC TRANSPORT OF ANTHROPOGENIC AEROSOLS IN AND THROUGH THE ARCTIC [ATMOSPHAERISCHER FERNTRANSPORT VON ANTHROPOGENEN AEROSOLEN IN UND DURCH DIE ARKTIS] c45
Wolfgang E. Raatz *In its* Reports of Meteorology, no. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 9-10 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The Arctic haze yearly occurring in the atmosphere during spring due to aerosols was investigated. The chemical composition of the aerosols shows that their origin lies in industrial areas at middle latitudes, i.e., long range atmospheric transport must occur. Increased aerosol concentrations are always observed during periods where an Arctic air mass is present; quasi-persistent circulation types were observed for several days, allowing transport across the Arctic. The origin of the transported air mass lies above industrial regions which are under the effect of an anticyclone characterized by drought and stability. Nine circulation types allowing such long range transport are identified. The circulation types show a seasonal variation. The transport is connected with wind velocities of 10 m/sec. The transport zones have a horizontal extent between 250 and 300 km and are at the level between 600 and 800 hPa. ESA

N87-11371 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
THE INFLUENCE OF VOLCANICS ON THE GROUND LEVEL AIR TEMPERATURE (1781-1984) [DER EINFLUSS DES VULKANISMUS AUF DIE BODENNAHE LUFTTEMPERATUR 1781-1984]
Peter Bissolli and Christian-Dietrich Schoenwiese *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 11-12 In GERMAN Sponsored by Deutschen Forschungsgemeinschaft (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The cooling effect of the ground level air temperature due to volcanic activity was investigated. Mean annual temperature estimates for the period 1781 to 1984 were used as Northern Hemisphere temperature series for a statistical analysis. Measuring grid point data were used for regional investigations. The volcanics data time series show that after single especially strong eruptions

a cooling is observed. A correlation analysis of the volcanics parameter with the Northern Hemisphere temperature data shows a negative correlation for all parameters. The coherence between volcanics parameters and the Northern Hemisphere temperature data is mainly significant in the long term (greater than 40 yr) range. The coherence analysis with regional temperature series shows that the long term coherence is mainly significant for high geographical latitudes and continental climates. ESA

N87-11372 Deutscher Wetterdienst, Offenbach am Main (West Germany). Inst. fuer Meereskunde.
DIAGNOSTIC INVESTIGATIONS OF THE INTERTROPICAL CONVERGENT ZONE [DIAGNOSTISCHE UNTERSUCHUNGEN DER INNERTROPISCHEN KONVERGENZZONE]
Eberhard Ruprecht, Michael Hantel, and Peter Speth *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 13-14 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The intertropical convergent zone (ITCZ) in the Atlantic-African domain was investigated as to position and structure of the ITCZ, waves connected with the ITCZ, and budgets relative to the ITCZ. Above the ocean ITCZ position can be determined from METEOSAT pictures in the IR domain. The transition between the two main positions (from January till May, and from June till November) is abrupt. Above the African continent the position of the ITCZ is very difficult to determine due to orographic effects. The periods during which the easterly waves partially responsible for the development of disturbances in the ITCZ occur were determined. It is confirmed that position and intensity of the ITCZ above the ocean are essentially determined by the easterly wave paths. ESA

N87-11373 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
VERTICAL ENERGY FLUXES AND MERIDIONAL HEAT TRANSPORT IN THE NORTH ATLANTIC OCEAN [VERTIKALE ENERGIEFLUESSE UND MERIDIONALER WAERMETRANSPORT IM NORDATLANTIK] **c46**
H.-J. Isemer and L. Hasse *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 15-16 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A method to interpolate the climatological data set obtained by Bunker for the North Atlantic into a regular 1 deg map grid was developed. The data set contains the mean monthly fields of the meteorological basic parameters of many years, and the deduced energy and momentum flux on the ocean-atmosphere boundary. The meridional heat transfer determined from the fields of the resulting net energy transfer was used to check independently calculated energy fluxes. The value of the short-wavelength radiation above the ocean, calculated by Bunker, was corrected. The parameterization coefficients for latent and sensible heat flux used by Bunker were improved. The differences between the obtained net energy fluxes and meridional heat transport and those of Bunker are discussed. ESA

N87-11374 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
NORTH ATLANTIC OSCILLATION (NAO) IN GROUND PRESSURE AND ITS SIGNIFICANCE FOR THE ATLANTIC-EUROPEAN AREA [DIE NORDATLANTIK-OSZILLATION (NAO) IM BODENDRUCK UND IHRE BEDEUTUNG FUER DEN ATLANTISCH-EUROPAEISCHEN RAUM]
Rita Glowienka-Hense *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 19-20 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The correlation between ground pressure anomalies in the Atlantic Ocean and Europe were investigated. The study is based on a ground pressure series from 1881 till 1984. An isolated signal is filtered from the ground pressure series using a two-step spatial hierarchy and a model based on the fact that the European continent is essentially influenced by the quasistationary centers Ireland low and Azores high. The negative pressure correlation between both centers (existing at least during Winter) is called the NAO. The results show that the NAO is a phenomenon existing above the Atlantic Ocean during the whole year, and having a direct coupling with the European area at least from December till July. ESA

N87-11375 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
MULTIVARIATE STATISTICAL INVESTIGATIONS OF THE PALEOCLIMATOLOGY OF CENTRAL EUROPE [MULTIVARIATE STATISTISCHE UNTERSUCHUNGEN ZUR PALAEOKLIMATOLOGIE MITTELEUROPAS]
Wolfgang Birrong *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the Terman Meteorologists Conference on the Global Climate and Our Environment 1986 p 21-22 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The climate before the beginning of the instrumental era (about 1700) was studied using paleoclimatological information from the last millenium. The correlations between climatological variables and paleontological information were analyzed. Since the paleontological information has a botanic nature, the treated quantities are integrated over the growth period and depend on the evolution of climatological parameters during this period. The results show a positive correlation with the temperatures of the summer half-year, and a negative correlation with the temperature of the summer of the previous year. ESA

N87-11376 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
STATISTICAL ANALYSIS OF SECULAR TEMPERATURE SERIES [STATISTISCHE ANALYSE SAEKULARER TEMPERATURREIHEN]
Juergen Malcher *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 23-24 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04B

A statistical analysis of 114 time series of the temperature near the ground in Europe period 1881 to 1980 was performed. Homogeneity tests were made in order to separate nonmeteorological effects from real climatological effects. Investigations of temperature trends over many years show a complicated picture since the long term variations were not in phase all over Europe. As a measure for the spatial correlations between the observed temperature variations the range for which the correlation is decreased to 0.7 is used. The evaluation shows that this characteristic range continuously increases from low to high latitudes and from maritime to continental climates. The year-to-year temperature variability shows the same geographic behavior as the spatial coherence. The analysis of the persistence interval shows an opposite behavior. The spectral variance analysis of the time series is used to classify the spectra according to the regions. ESA

N87-11377 Technische Hochschule, Darmstadt (West Germany). Inst. fuer Meteorologie.
TIME SERIES ANALYSIS AND COMPOSITE ANALYSIS OF EQUATORIAL OBSERVATIONS FROM SHIPS [ZEITREIHEN- UND KOMPOSITANALYSE AEQUATORIALER SCHIFFSBEOBACHTUNGEN]
Heribert Fleer and Udo Schneider *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p25-26 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04B

Synoptic measurements from ships in the period 1872 to 1983 were studied in order to analyze the temporal and spatial distribution of the sea surface temperature and the wind in the tropical Pacific. The variance spectra of the time series of sea

surface temperature and zonal and meridional wind components show a broad maximum in a period domain of 2 to 7 yr. The composites of the fields of sea surface temperature and ground wind determined to investigate the development of El Nino events and reveal anomalies in sea surface temperature and wind components. ESA

N87-11378 Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
A METHOD FOR CORRELATION ANALYSIS IN CLIMATOLOGY [ZUR METHODE DER KORRELATIONSANALYSE IN DER KLIMAFORSCHUNG]
Harald Weingaertner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 27-28 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04B

A measure of contingency was derived in order to determine the contingency between metrically, ordinally and nominally scaled random variables. A contingency coefficient was derived which is zero for completely stochastic independence between the variables, and one for complete dependence. The contingency measure is independent of the chosen classification and is distribution-free. For the special case of a two-dimensional gaussian distribution the contingency coefficient is equal to the classical correlation coefficients. The practical application of distribution-free contingency coefficients in climatology is explained by an autocorrelation analysis of general weather situations. ESA

N87-11379 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
ACCURACY ANALYSIS OF SATELLITE EXPERIMENTS FOR THE MEASUREMENT OF THE RADIATION BUDGET [EINE GENAUIGEKEITSANALYSE VON SATELLITENEXPERIMENTEN ZUR MESSUNG DER STRAHLUNGSBILANZ] c46
Rolf Stuhlmann, Heinrich Knottenberg, Ehrhard Raschke, and Matthias Wiegner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 29-30 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04A

The sources of error as a function of different scanning geometrics in the Earth Radiation Budget Experiment are presented. The errors result from the filtering of the observed fields due to the limiter radiometer observation fields, and from the nonuniform distribution of measuring values within a region. Another difficulty is that satellites only measure twice per day above each region. The global error is estimated using an Earth radiation model. This is used to predict errors in dependence on shot statistics, satellite orbit, scanning geometry, measuring instrument, inversion algorithm, and approximation process. ESA

N87-11380 Hamburg Univ. (West Germany). Inst. fuer Meereskunde.
CLIMATE-EFFECTIVE TRANSPORT PROCESSES IN THE OCEAN [KLIMAWIRKSAME TRANSPORTPROZESSE IM OZEAN]
Jens Meincke *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 31-33 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04B

The roles of transport processes in the ocean in the climate, from a global and mesoscale point of view, are treated. The global thermohaline system (the largest coherent circulation system of the ocean) is presented. The climatologically most important aspect is the long term storage of anomalies of the heat, water, and gas budget in the declination regions. The poor accuracy of the estimates is expected to be improved by anthropogenic tracers and the measurements in the framework of the World Ocean Circulation Experiment. Mesoscale details of the water mass transformation in the European North Sea are discussed. The coupling between the oceanic transport processes and the climatological system is explained by an anomaly in the effect of the atmospheric conditions on the ocean. ESA

N87-11381 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
MEASUREMENT OF SUBSCALE CLIMATOLOGICAL PROCESSES BY DIAGNOSIS OF SCALED BUDGETS [MESSUNG SUBSKALIGER KLIMAPROZESSE DURCH DIAGNOSE SKALIGER HAUSHALTE]
Michael Hantel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on Global Climate and Our Environmentl 1986 p 34-35 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity CSCL 04B

The indirect measurement of subsynoptic quantities determined as residues of atmospheric budgets is discussed. Subscale fluxes (of mass, energy, momentum, trace elements) cannot be resolved by measuring systems, but have to be known due to the nonlinearity of the fluxes which means that point measurements are essentially not sufficient. The equation of specific moisture containing synoptically analyzed fields and the subsynoptic vertical moisture flux is discussed. Three subsynoptic heat fluxes were measured in the ALPEX-experiment with an accuracy of 30 W/sqm. Application of the method in the ocean results in the measurement of subsynoptic vertical fluxes in the free atmosphere by the diagnosis of synoptic budgets with a minimum of parameterization. ESA

N87-11382 GKSS-Forschungszentrum Geesthacht (West Germany).
SUBGRID PARAMETERIZATION IN FLOWS WITH HELICITY [SUBGRID-PARAMETRISIERUNG IN STROEMUNGEN MIT HELIZITAET] c46
M. Lautenschlager, D. Eppel, and W. C. Thacker *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 36-37 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A turbulence parameterization which emphasizes the turbulence vortex structure is presented. Rotational structures with helicity occurring in the atmosphere on a large scale were treated. Only the interaction between larger atmospheric vortices represented in the length scales of the grid of the numerical simulation model, and can be taken into account. The effect of the motion in the subgrid range which is not resolved in the grid has to be parameterized. The subgrid helicity is taken into account by developing the subgrid fluxes in terms of average, absolute vorticity. The terms containing helicity change the dispersive flow behavior. It is shown that positive helicity retards the transport of short waves, and that this parameterization stabilizes and intensifies rotating structures. ESA

N87-11383 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
MODELING OF RADIATION AND CLOUD CHARACTERISTICS FOR MODELS OF GENERAL CIRCULATION AND CLIMATE [UEBER DIE MODELLIERUNG VON STRAHLUNGS- UND WOLKENEIGENSCHAFTEN FUER MODELLE DER ALLGEMEINEN ZIRKULATION UND DES KLIMAS] c46
Burkhardt Rockel, Ehrhard Raschke, and Gaoxiang Zhao *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 38-39 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The parameterization of the processes in clouds, playing a role in the energy budget of the climatological system is discussed regading general circulation models (GCM) and climate. The parameterization of cloud coverage and liquid water content does not meet the requirements of radiation transfer models in most of the climatological models. The structure of a cloud and radiation model (CRM) for circulation is described. The relations between

the component of the CRM and the GCM are explained. The GCM provides the input data required for the CRM. ESA

N87-11384 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

THE INTERACTION BETWEEN ADVECTION, RADIATION, TURBULENCE, AND MICROPHYSICS IN THE FORMATION OF ARCTIC STRATUS CLOUDS [ZUR FRAGE DER WECHSELWIRKUNG VON ADVEKTION, STRAHLUNG, TURBULENZ UND MIKROPHYSIK BEI DER BILDUNG ARKTISCHER STRATUSWOLKEN]

P. Wendling and J. E. Finger *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 40-41 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The formation of stratus clouds in the North Polar region is discussed. The determining factors for the formation of stratus clouds are the synoptic conditions and the polar ocean as a source of humidity which is enhanced during the summer months. In most cases stratus can only be formed in the Arctic regions when a depression or advection inversion is available and when warm humid air masses simultaneously flow in the central Arctic. A one-dimensional boundary layer model shows that after condensation and further growth of cloud droplets, a close interaction exists between the radiation characteristics of the Arctic stratus, its vertical extent, and its microphysical, properties (concentration and size distribution of the cloud elements); the important role of aerosols has to be taken into account. The role of entrainment in the formation and disintegration of Arctic stratus clouds is not clarified. Measurements in the Marginal Ice Zone Experiment are discussed. ESA

N87-11385 Osnabrueck Univ. (West Germany). Inst. fuer Biologie/Chemie.

THE CARBON EXCHANGE BETWEEN ATMOSPHERE AND TERRESTRIAL BIOSPHERE [ZUM KOHLENSTOFFAUSTAUSCH ZWISCHEN ATMOSPHAERE UND TERRESTRISCHER BIOSPHAERE] c46

G. Esser *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 42-43 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A model of the carbon flux in the terrestrial biosphere was developed. After coupling to an ocean and atmospheric model, this model was used to investigate the global carbon cycle. Anthropogenic effects from land use changes are taken into account in the model; another determining model criterion is the direct (CO_2-fertilization effect) and indirect (climate) effect of anthropogenic fossile carbon emissions. The model shows for the period 1860-1981 a release of 100 Gt carbon; the global phytomass is increased by 20 Gt due to the fertilization effect. Since 1860 the atmospheric CO_2-concentration increased by 283 ppm, a value which is confirmed by ice samples. ESA

N87-11386 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.

THE CALCULATION OF THE FLOW RESISTANCE OF OROGRAPHIC OBSTACLES USING A MESOSCALE MODEL [STROEMUNGSWIDERSTAND OROGRAPHISCHER HINDERNISSE MIT EINEM MESOSKALIGEN MODELL BERECHNET] c46

Stefan Emeis and Franz Fiedler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 44-45 In GERMAN Sponsored by Deutschen Forschungsgemeinschaft (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The integration of mesoscale obstacles in large scale flow models (numerical forecasting models) is discussed. The flow resistance consists of pressure and friction resistance; only the former is taken into account. The two-dimensional mesoscale model contains the complete momemtum and heat budget equations with a second order closure law for the turbulent flows. The perturbation pressure has a hydrostatic and a dynamic part. Lamination and orographic height were varied as external parameters in the simulation with the model for a single obstacle. In stable lamination the pressure distribution is asymmetric; in neutral lamination it is almost symmetric and the pressure resistance is several times smaller. ESA

N87-11387 Mainz Univ. (West Germany). Inst. fuer Meteorologie.

A TWO-DIMENSIONAL NUMERICAL MODEL FOR FOG PROGNOSIS [EIN ZWEIDIMENSIONALES NUMERISCHES MODELL ZUR NEBELPROGNOSE]

Renate Forkel and Wilford Zdunkowski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 46-47 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A two-dimensional fog model which can take into account relevant processes due to the large number of advective fog development possibilities and the strong local variations of fog, is presented. The atmospheric model provides a prognosis of temperature, global water concentration, aerosol concentration, and wind field. Fog formation in an urban area is described. The model allows sensitivity studies in the mesoscale domain, e.g., for the investigation of factors influencing the fog's life cycle. ESA

N87-11388 Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).

THE EVAPORATION OF SEVERAL TYPES OF VEGETATION AND ITS MODELING BY A SIMPLE INVENTORY CLIMATE MODEL [DIE VERDUNSTUNG VERSCHIEDENER VEGETATIONSTYPEN UND IHRE MODELLIERUNG DURCH EIN EINFACHES BESTANDKLIMAMODELL]

F. Wollenweber *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 48-49 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The evaporation of natural surfaces was simulated with an inventory climate model. The evaporation depends on biological parameters and meteorological factors. The vegetation inventory was treated in a six-layer model, with a heat budget equation for each inventory layer. The transpiration resistance essentially depends on the resistance of the leaf boundary layer and on the stomata resistance. The flow of latent heat via a vegetation inventory as a function of several parameters is explained. A potential evapotranspiration occurs if it is assumed that the plants can evaporate undisturbed. ESA

N87-11389 GKSS-Forschungszentrum Geesthacht (West Germany).

A COMPARISON OF SEVERAL MODELS FOR THE CALCULATION OF GROUND TEMPERATURE AND GROUND MOISTURE [EIN VERGLEICH VERSCHIEDENER MODELLE ZUR BERECHNUNG DER BODENTEMPERATUR UND BODENFEUCHTE] c46

Martin Clausen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 50-51 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The question of how complex a model for heat and water transport in the ground has to be in order to give a suitable prediction of the soil temperature and moisture, is treated. The model of Sievers et al deduces equations for the temperature, water vapor, and liquid water in the soil from the first fundamental law of thermodynamics and the conservation of mass. This model can be used as a reference for simpler models due to its completeness. McCumber and Pielke use in their mesoscale model a parametric model of the water and heat transport in the soil.

This model is not capable of describing the abrupt occurrence of the evaporation barrier. Very simple models of soil temperature and moisture are sufficient for short term predictions in dry weather and for long term predictions in heavy precipitation. ESA

N87-11390 Deutscher Wetterdienst, Offenbach am Main (West Germany).
MEASUREMENT, CALCULATION, AND PARAMETERIZATION OF ATMOSPHERIC HEAT RADIATION [MESSUNG, BERECHNUNG UND PARAMETRISIERUNG DER ATMOSPHAERISCHEN WAERMESTRAHLUNG] c46
G. Czeplak *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 52-53 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A parameterization formula for the atmospheric heat radiation was made using measurements with a pyrradiometer and radiosondes. The pyrradiometer measurements were compared with the radiation model applied to the radiosonde measurements. The results of the model calculations for a clear-air, nocturnal atmosphere agree well with the pyrradiometer measurements and with the Swinbank parameterization formula. A modified Swinbank formula for operational use is presented. A parameterization formula for the case of a cloudy sky was deduced. The available data are not sufficient for a statistical verification of the formulas. ESA

N87-11391 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
HEATING OF THE ATMOSPHERE BY PARTICLE ABSORPTION SHORT WAVELENGTH RADIATION [ERWAERMUNG DER ATMOSPHAERE INFOLGE ABSORPTION KURZWELLIGER STRAHLUNG IN TEILCHEN]
G. Haenel, R. Busen, and R. Schloss *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 54-55 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

In situ measurements of the solar radiation absorbed by particles in the atmosphere were performed. A measuring method for the particle volume absorption rate of short wave radiation was developed, allowing the experimental determination of the time dependence of the volume absorption rate and the concomitant heating rate of the atmosphere. Further climatologically important parameters can be estimated from the measurements. ESA

N87-11392 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
A COMPARISON BETWEEN DETAILED AND PARAMETERIZED FORMULATIONS OF DROPLET/DROPLET COAGULATION MECHANISMS [EIN VERGLEICH ZWISCHEN DETAILLIERTER UND PARAMETRISIERTER FORMULIERUNG VON TROPFEN/TROPFEN-KOAGULATIONSMECHANISMEN]
K. D. Beheng and G. Doms *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 56-57 In GERMAN Previously announced as N86-21572 (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The coagulation interaction between droplets in clouds in the formation process of precipitation is discussed. The coagulation mechanisms taken into account in the stochastic coagulation equation are autoconversion, accretion, and self collection of cloud droplets and raindrops. The stochastic equation provides a mathematical expression for the modification rates of any moment of the cloud droplet and raindrop part of the droplet distribution function, especially the modification rates of number and mass densities. The latter are compared with parameterization assumptions. As an example, the parameterization method of Kessler is presented. The detailed formulation for a numerical treatment requires an initial droplet spectrum depending on several parameters. The differences between parameterized and detailed rates of rainwater conversion by autoconversion and accretion are substantial. This comparison shows that the Kessler method is not suited for the parameterization of autoconversion and accretion. ESA

N87-11393 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
A SIMPLE PARAMETERIZATION SCHEME FOR THE DETERMINATION OF THE RELATIVE COVERAGE BY CUMULUS CLOUDS [EIN EINFACHES PARAMETRISIERUNGSSCHEMA ZUR BESTIMMUNG DER RELATIVEN BEDECKUNG DURCH CUMULUSWOLKEN]
Paul Becker *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 58-59 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A parameterization scheme which allows the calculation of relative cumulus coverage taking into account the upward-current air tube, the region with active clouds outside this tube (outer region), and decaying cloud material was developed. The scheme allows the determination of the degree of coverage as a function of the specific liquid water content in the cloud, the temperature, and the specific humidity. Good agreement is found between the calculated global coverage and satellite observations. ESA

N87-11394 Alfred-Wegener-Inst. for Polar Research, Bremerhaven (West Germany).
PHYSICAL PROCESSES IN THE ATMOSPHERIC BOUNDARY LAYER AT THE PACK-ICE BORDER [PHYSIKALISCHE PROZESSE IN DER ATMOSPHAERISCHEN GRENZSCHICHT AM PACKEISRAND] c46
Christian Wamser and Guenter Kellner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 60-61 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Measurements were performed from an ice breaker in the sea between Spitsbergen and Greenland in order to study phenomena at the sea ice border. The measurements show the effect of the sea surface characteristics on the development of the atmospheric boundary layer. The variance spectra of the vertical wind component show a strongly reduced turbulence above the ice and suggest intensive convection processes in the boundary layer above the sea which is treated from below. ESA

N87-11395 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie.
ATMOSPHERIC PROCESSES AT THE BOUNDARY OF THE ANTARCTIC CONTINENT [ATMOSPHAERISCHE PROZESSE AM RANDE DES ANTARKTISCHEN KONTINENTS] c46
Christoph Kottmeier, Hans-Juergen Belitz, and Hans-Ulrich Stuckenberg *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 62-63 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Time series of wind and temperature measurements were obtained at an Arctic weather station near the coast. The observed frequency distributions are explained by the predominant synoptic conditions. A quantitative explanation results from the analysis of a formulation of the boundary layer equations with a simple parameterization of friction and baroclinity. ESA

N87-11396 GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
SCALE-DEPENDENT MODELS FOR CLIMATOLOGY [SKALENABHAENGIGE MODELLE FUER DIE KLIMAFORSCHUNG]
Hartmut Grassl *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 64-66 In

GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Climatology models are introduced. The usual distinction between scales (synoptic or large scale domain, mesoscale or regional domain, microscale) is not always suited for the climatological processes; there is interaction between several system components of different extent. Measurements and numerical models are required to understand these interactions. In many applications the complete set of equations describing the climate model is strongly reduced, depending on the problem to be solved. ESA

N87-11397 Westfaelische Wilhelms Univ., Muenster (West Germany). Inst. fuer Geographie.
CLIMATE MODELS: THEIR APPLICATION IN THE INVESTIGATION OF TRACE GASES AND THE IMPACT ON CLIMATE [KLIMAMODELLE: IHRE ANWENDUNG IN DER SPURENGAS- UND WIRKUNGSFORSCHUNG]
Wilfrid Bach *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 67-71 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Applied climatology in the field of anthropogenic effects on the climate is reviewed. The presence in the atmosphere of the most important trace gases which have an effect on the absorption of sunlight is discussed. The hierarchy of climate models for the simulation of the impact of trace gases is presented; they can be roughly divided into thermodynamic and hydrodynamic models. The energy, carbon cycle, and climate models used to determine the transient response of the climate to CO2 changes are explained. The contribution of trace gases to the increase of the soil temperature, and simulations for the case of CO2 are explained. Climate scenarios for the study of the interactions between climate and society are discussed. ESA

N87-11398 Technische Univ., Munich (West Germany). Inst. fuer Meteorologie.
CLIMATE MODELS WITH STOCHASTIC EXCITATION [KLIMAMODELL MIT STOCHASTISCHER ANREGUNG]
Werner Metz *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 72-73 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The contribution of fast fluctuating small-scale (synoptic) phenomena (stochastic excitation) to the variance of atmospheric flow was studied with a climate model based on the quasigeostrophic approximation for a barotropic flow. The integration domain for the model covers the Northern Hemisphere. The observed atmospheric variance and blocking highs were simulated. It is shown that the mechanism of an excitation on synoptic scale is significant for the long term variability of the atmosphere. ESA

N87-11399 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
INTERACTIVE COUPLING OF OCEANIC TOP LAYER MODELS AND ATMOSPHERIC CIRCULATION MODELS [INTERAKTIVE KOPPLUNG VON OZEANISCHEN DECKSCHICHTMODELLEN AN ATMOSPHAERISCHE ZIRKULATIONSMODELLE] c46
Joachim Biercamp *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 74-75 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The inteactive coupling of oceanic and atmospheric models in the study of the interaction between ocean and atmosphere and its role in climate changes, is discussed. This interactive coupling leads to numerical problems due to the different reaction times of the media water and air, and errors due to feedback effects. The two applied models are presented. Empirical correction terms were applied in order to avoid errors due to coupling between the model components; the value of these terms is discussed. ESA

N87-11400 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
THE EFFECTS OF MOUNTAINS ON BLOCKING IN A CIRCULATION MODEL. CONSIDERATION OF THE ANGULAR MOMENTUM BALANCE [GEBIRGSEFFEKTE BEI BLOCKBILDUNGEN IN EINEM ZIRKULATIONSMODELL. BETRACHTUNG DER DREHIMPULSBILANZ] c46
Guenter Fischer *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 76-77 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Momentum balance equations were analyzed in order to study the effect of mountains on circulation blocking phenomena. In the vertically and zonally averaged angular momentum equation the mountain effect appears via an angular momentum acting via a pressure distribution which competes with the other moments and the flux divergence. Six blocking phenomena due to mountain effects were evaluated and are explained. ESA

N87-11401 Deutscher Wetterdienst, Offenbach am Main (West Germany).
CLOUD PARAMETERIZATION WITH A STATISTICAL METHOD [WOLKENPARAMETRISIERUNG MIT EINEM STATISTISCHEN VERFAHREN]
E. Heise *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 78-79 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The Sasamori (1975) diagnostic method for the calculation of cloud coverage and cloud liquid water content is discussed. This model strongly emphasizes the effect of the vertical velocity. The main assumption is that each atmospheric layer consists of a large number of air packages which have different vertical velocity (statistical distribution) due to turbulent phenomena. The cloud coverage mainly depends on the mean vertical velocity, while the variance has an important influence on the liquid water content. Mean value and variance are estimated in simulation experiments. Significant improvements in the liquid water content are obtained compared to other models. ESA

N87-11402 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
COUPLED OCEAN-ATMOSPHERE MODELS WITHOUT DRIFT OF THE PROGNOSTIC VARIABLES [GEKOPPELTE OZEAN-ATMOSPHAEREN-MODELLE OHNE DRIFT DER PROGNOSTISCHEN VARIABLEN] c46
Robert Sausen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 82-83 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The avoidance of the drift of prognostic variables by a suitable correction of the fluxes between ocean and atmosphere was studied. This flux correction is explained by a schematic representation of a coupled ocean-atmosphere model. The efficiency of the correction is demonstrated with two examples. ESA

N87-11403 Westfaelische Wilhelms Univ., Muenster (West Germany). Inst. fuer Geographie.
SIMULATION OF THE EFFECT OF ATMOSPHERIC TRACE GASES ON THE GLOBAL AVERAGE TEMPERATURE DISTRIBUTION [SIMULATION DES EINFLUSSES ATMOSPHAERISCHER SPURENGASE AUF DIE GLOBAL GEMITTELTE TEMPERATURVERTEILUNG]
Hans J. Jung and Wilfrid Bach *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 86-87 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The dependence of simulated atmospheric temperature variations on the contribution of single gases and feedback

processes was calculated using a radiative-convective model. The interactions between tropospheric temperature gradients and moisture distribution and between temperature and cloud characteristics are emphasized. The soil temperature change in case of a doubling of the present trace gas concentrations was calculated. The dependence of soil temperature and global cloud coverage degree on the average vertical liquid water content and the duration of presence of H2O in the atmosphere is shown for the case of parameterization of cloud feedback effects. The results of sensitivity studies show that the feedback processes lead to a temperature increase between 1.5 and 2.6 K. ESA

N87-11404 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.

SIMULATION OF THE CLOUD COVERAGE IN A CLIMATE MODEL [SIMULATION DER WOLKENBEDECKUNG IN EINEM KLIMAMODELL]

Erich Roeckner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 90-91 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A method for cloud parametrizations in climate models is discussed. The method is based on the separation of the continuity equations for the water vapor and liquid water of clouds. The suppositions for the time integration of the prognostic equations are given. The cloud parameterization method was tested in several hemispheric and global versions of an atmospheric circulation model. A comparison with observed data shows that all parameters simulated with the model are within the scatter. Test calculations show a difference between solar constants with and without clouds. ESA

N87-11405 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.

THE RESPONSE OF THE GLOBAL ATMOSPHERE TO THE EXTRAORDINARY EL NINO SEA SURFACE TEMPERATURE ANOMALY IN JANUARY 1983: SIMULATION [DIE ANTWORT DER GLOBALEN ATMOSPHAERE AUF DIE AUSSERGEWOEHNLICHE EL NINO MEERESOBERFLAECHENTEMPERATURANOMALIE IN JANUAR 1983: SIMULATION] c46

Hans vonStorch and Ulrich Cubasch *In* Deutscher Wetterdienst Reports of Meteorology No. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment 1986 p 92-93 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The effect of the sea surface temperature anomalies occuring during El Nino phenomena on atmospheric circulation anomalies was investigated using a simulation calculation with a circulation model. The simulated response agrees well with the atmospheric anomalies observed in 1983. The control circulation experiment consists of 4 simulation calculations and is integrated over 10 yr. The tropical El Nino signal and the extratropical response (Northern Hemisphere; 500 mbar topography) are described. ESA

N87-11406 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.

THE RESPONSE OF THE TROPICAL ATMOSPHERE TO THE EXTRAORDINARY EL NINO SEA SURFACE TEMPERATURE ANOMALLY 1982-1983: OBSERVATION [DIE ANTWORT DER TROPISCHEN ATMOSPHAERE AUF DIE AUSSERGEWOEHNLICHE EL NINO MEERESOBERFLAECHENTEMPERATURANOMALIE 1982/83 - BEOBACHTUNG] c46

Hans vonStorch and Rolf Doberitz *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 94-95 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The El Nino events in 1982-1983 were observed. The outgoing long wave radiation (OLR) was routinely measured by satellites. The results show that sea surface temperature (SST), precipitation, and soil pressure oscillate in phase; the correlations between them can be as high as 80% to 90%. Cloud distributions consistent with OLR anomalies are observed. ESA

N87-11407 Deutscher Wetterdienst, Offenbach am Main (West Germany).

MODEL SIMULATIONS OF THE COASTAL EXPERIMENT PUKK [MODELLSIMULATIONEN ZUM KUESTENEXPERIMENT PUKK]

H. W. Detering, D. Etling, and M. Wamser *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 96-97 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The coastal climate was simulated using a two-dimensional numerical mesoscale model. The starting points for the model calculations were the observed geostrophic wind and the temperatures at 2m height measured at several stations in the PUKK region. Significant differences between the calculated and the observed wind structures are found. The reasons are the inaccurate knowledge of the initial conditions and the suppositions concerning the parameterization of the turbulent vertical exchange in the development of the coastal boundary layer. It is shown that besides advection and radiation effects, diffusion phenomena in the lower atmospheric layers have to be well determined in the simulation of mesoscale phenomena. ESA

N87-11408 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.

THE SIGNIFICANCE OF INITIALIZATION FOR THE UNSTEADY SIMULATION OF MESOSCALE FLOWS [DIE BEDEUTUNG DER INITIALISIERUNG FUER DIE INSTATIONAERE SIMULATION MESOSKALIGER STROEMUNGEN] c46

Gerhard Adrian *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 98-99 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

An initialization method for mesoscale models is presented. This method determines the initial values required for unsteady simulations from measurements. The method is based on a variational system which enables spatial extrapolation and interpolation and takes into account the measured data at different times. A functional is defined, the minimum of which is determined. Comparison of simulations with mesoscale data bases show that in the mesoscale gamma the model simulations are determined by the initial values for many hours. Quantative predictions from simulations require an objective initialization method which determines the initial values from measurements. ESA

N87-11409 GKSS-Forschungszentrum Geesthacht (West Germany).

THE DYNAMIC BASIC STRUCTURE OF THE GEESTHACHT (WEST GERMANY) MESOSCALE MODEL [DAS DYNAMISCHE GRUNDGERUEST DES GEESTHACHTER MESOSKALENMODELLS] c46

D. Eppel and H. Kapitza *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 100-101 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

An atmospheric circulation model for the investigation of phenomena in the beta and gamma mesoscale domain was developed. The basic equations are the sound-wave-filtered monemtum and energy equations, and the transport equations for air admixtures and for the different phases of the water cycle. The numerical grid can be nonequidistant in all three coordinate directions. The integration algorithm and the conditions which it has to fullfil are described. ESA

N87-11410 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

A MESOSCALE CLIMATE MODEL FOR THE INVESTIGATION OF ATMOSPHERIC FLOWS UNDER THE INFLUENCE OF OROGRAPHY, TURBULENCE, AND CLOUD PHYSICS [EIN MESOSKALIGES KLIMAMODELL ZUR UNTERSUCHUNG ATMOSPHAERISCHER STROEMUNGEN UNTER DEM EINFLUSS VON OROGRAPHIE, TURBULENZ UND WOLKENPHYSIK]

U. Schumann, T. Hauf, H. Hoeller, H. Schmidt, and H. Volkert *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 102-103 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The simulation model MESOSCOP for the study of the effect of mesoscale phenomena on the climate is presented. The model allows the calculation of three-dimensional, unsteady, and nonhydrostatic flows. The basis of the model are the differential balance equations for mass, momentum, and scalar components. Model suppositions for up to eight particle species are used in the cloud physics part. The equations are approximated on the basis of a staggered grid using finite differences. The computer programs have a modular structure according to a uniform scheme, and are vectorized for the Cray, although they can be used on any scalar computer. Preliminary tests show that MESOSCOP is suited for mesoscale climate studies ESA

N87-11411 Mainz Univ. (West Germany). Inst. fuer Meteorologie.

NUMERICAL SIMULATION OF THE URBAN CLIMATE USING A 3-DIMENSIONAL MODEL [NUMERISCHE SIMULATION DES URBANEN KLIMAS MIT EINEM DREIDIMENSIONALEN MODELL]

Joachim Eichhorn, Reinhold Schrodin, and Wilford Zdunkowski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 104-105 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The simulation model Mainz Urban Simulation Model (MAUSI) for the study of the effects of city planning changes on the urban climate is presented. The model is three-dimensional in order to allow reliable forecasting in extremely inhomogeneous areas. The MAUSI is a nonhydrostatic, mesoscale, highly resolving forecasting model. It uses the equations of motion in their original form, Boussinesq approximated, with a divergence free flow field. The calculations performed for a model city demonstrate the efficiency of the model. ESA

N87-11412 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie.

SOLAR RADIATION TRANSPORT IN REALISTIC ATMOSPHERES WITH 3-DIMENSIONAL CLOUD FIELDS [SOLARER STRAHLUNGSTRANSPORT IN REALISTISCHEN ATMOSPHAEREN MIT DREIDIMENSIONALEN WOLKENFELDERN] **c46**

Thomas Trautmann and Wilford Zdunkowski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 106-107 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The transport of solar radiation (0.28 to 6 micron) in idealized rectangular clouds and regular, horizontally infinitely extended cloud fields with identical cloud elements was studied. The finite analytical model of Davies was used for the description of an isolated rectangular cloud. This model was extended to cloud fields and its limitations were approximately overcome by taking into account reflection on the Earth and water vapor absorption above and below the cloud field. The spectral integration over the solar spectrum was performed with the exponential fit method. The calculations show, in comparison with a nonreflecting Earth surface, an additional solar heating of maximum 0.3 to 0.4 K/hr at the lower boundary of the cloud elements due to multiple reflection between Earth (albedo 20%) and cloud field. ESA

N87-11413 Technische Hochschule, Darmstadt (West Germany). Inst. fuer Meteorologie.

CONCLUSIONS FROM THE MIGRATION OF BARCHANS ON THE DOMINATING WIND CONDITIONS IN DESERT REGIONS [RUECKSCHLUESSE AUS DER WANDERUNG VON BARCHANEN AUF DIE VORHERRSCHENDEN WINDVERHAELTNISSE IN WUESTENGEBIETEN]

F. Wippermann and G. Gross *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 108-109 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The displacement of barchans was studied in order to determine the dominating wind behavior in a region. Barchans can only be formed where the wind has practically a constant direction. Precise measurements of a dune field with a time difference of a few years allow conclusions as to the dominating wind direction. The correlation between displacement velocity of barchans and the average wind velocity is still largely unexplained. The numerical simulation of the formation and displacement of barchans is explained. ESA

N87-11414 Freie Univ., Berlin (West Germany).

THE INTERNAL MEMORY OF OPEN HYDRODYNAMIC SYSTEMS [DAS GEDAECHTNIS INTERN OFFENER HYDRODYNAMISCHER SYSTEME]

Heinz Fortak *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 110-114 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The treatment in spectral form of any complex hydrodynamic system (even consisting of partial systems) is explained. In the case of long term integrations, especially for composed systems with different time constants, memory effects have to be taken into account. Increasingly powerful computers open the possibility of a direct numerical integration of the molecular Navier-Stokes equations. ESA

N87-11415 Marburg Univ. (West Germany). Fachbereich Physik.

TURBULENCE THEORY FROM A PRESENT-DAY POINT OF VIEW [THEORIE DER TURBULENZ AUS HEUTIGER SICHT] **c34**

Siegfried Grossmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 115-118 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The rapid progress in the field of turbulence physics during the last decade is depicted. Transition from the turbulent to the laminar state, and the explanation of fully developed turbulence by means of the Navier-Stokes equation are discussed. Weak and strong turbulence are mentioned. ESA

N87-11416 Technische Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.

PHENOMENOLOGY OF THE EVOLUTION OF LARGE-SCALE BOUNDARY LAYER STRUCTURES [PHAENOMENOLOGIE DER EVOLUTION GROSSRAEUMIGER GRENZSCHICHSTRUKTUREN] **c46**

Hans-Joachim Lange *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 119-120 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A numerical barotropic two-layer model for the large scale dynamic interaction between the atmospheric boundary layer and the free atmosphere is presented. The atmospheric boundary is represented by the usual flat water equations, while the free

atmosphere equations are identical with the Ekman layer vertically integrated equations of motion and momentum. The model generalizes the classical Ekman pumping theory. It is shown that the environment imposes on the free boundary a compulsion to vertical momentum transport from above to below, and the structure formation, the appearance of a front, results from this compulsion. The analogy between this result and the synergetic theory of Benard convection is explained. ESA

N87-11417 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
NUMERICAL INVESTIGATION OF THE NONLINEAR DYNAMICS OF BOUNDARY LAYER ROLLS [NUMERISCHE UNTERSUCHUNGEN ZUR NICHTLINEAREN DYNAMIK VON GRENZCHICHTROLLEN] c46
Andreas Chlond *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 121-122 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A two-dimensional spectral model was developed for the investigation of the nonlinear dynamics of rolls in an atmospheric boundary layer heated from below and enclosed by an inversion from above. The mathematical-physical basis are the Boussinesq approximated equations of motion, continuity, and heat transfer written in the form of balance equations for a horizontally homogeneous basic flow and a secondary circulation. Subscale processes are parameterized with a gradient supposition. The model can be used to investigate the conditions leading to the formation of convective flow models, and to predict the spatial and temporal structure of the convection above the critical value and the concomitant transport of properties. Calculated and measured profiles of the dimensionless vertical transport of momentum and temperature agree well. ESA

N87-11418 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalisches.
A NONLINEAR THEORY OF BAROCLINIC INSTABILITY [EINE NICHT-LINEARE THEORIE DER BAROKLINEN INSTABILITAET]
Peter Nevir *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 123-124 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A physical and mathematical model was developed in order to study the nonlinear evolution of a baroclinic weakly unstable wave. The model is a nonlinear extension of the quasi-geostrophic two-layer model of a baroclinic instability in the beta plane, in which friction is caused by Ekman layers on two fixed horizontal boundary planes. The model describes the growth of a barocline wave perturbation in a two-layer shear flow. The bifurcation method of multiple scales was used to derive the evolution of the wave amplitude in the case of a nonlinear baroclinic wave regime with and without frictional dissipation. ESA

N87-11419 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
EVOLUTION THEOREMS FOR DISSIPATIVE PROCESSES. GENERAL AND METEOROLOGICAL ASPECTS [EVOLUTIONSTHEOREME BEI DISSIPATIVEN PROZESSEN - GENERELLE UND METEOROLOGISCHE ASPEKTE]
Fritz Herbert *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 125-130 In GERMAN (For primary document see N87-11367 02-47)
(Contract DFG-HE-1243/1,2)
Avail: Issuing Activity

Evolution principles governing nonlinear irreversible processes which lead to the spontaneous formation of temporal and spatial structures are discussed. Entropy production plays a central role in dissipative nonequilibrium systems. The fundamental theorem of Glansdorff and Prigogine is explained. The minimum-entropy theorem can only be applied to a limited extent due to the nonlinearity of the meteorological processes. The stability behavior of the stationary state of nonlinear irreversible processes is discussed. The condensation growth of cloud droplets, and the energy transfer of unpolarized radiation are treated. It is shown that the thermodynamic behavior can lead to dissipative structure formation due to the effect of nonlinear irreversible processes. Questions raised by the introduction of radiation in the thermodynamics of nonequilibrium processes are discussed. ESA

N87-11420 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalisches.
DESCRIPTION OF MATTER-RADIATION INTERACTIONS AS NONLINEAR IRREVERSIBLE PROCESSES [BESCHREIBUNG VON MATERIE-STRAHLUNG-WECHSEL WIRKUNGEN ALS NICHT-LINEARE IRREVERSIBLE PROZESSE] c46
Ulrich Callies *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 131-132 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The consideration of interactions between matter and radiation in meteorological phenomena is discussed. The treatment of the radiation field as an independent thermodynamic subsystem opens up all theorems of the theory of irreversible processes for the global system Earth-atmosphere, and eliminates difficulties concerning the formulation of boundary conditions. The theoretical treatment and the numerical modeling of the entropy production due to solar radiation is explained. The nonlinearity of the system excludes the validity of the minimum-entropy principle. ESA

N87-11421 Deutscher Wetterdienst, Offenbach am Main (West Germany).
THERMODYNAMIC ASPECTS OF THE ABSORPTION OF GAS IN DROPLETS [THERMODYNAMISCHE ASPEKTE DER GASAUFNAHME IN TROPFEN] c77
Ulrike Wacker *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 133-134 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The simultaneous absorption-desorption of several partial trace gases by droplets in the atmosphere was investigated. A general equation for the mass absorption rate of a droplet was derived by considering a closed global system consisting of two open subsystems, namely a droplet and a gas mixture. This general equation can be applied to any gas since it does not contain any assumption which is valid only for specific gases. The time evolution of the gas absorption and the acidification of raindrops can be simulated in order to study formation of acid rain. In order to demonstrate the mutual effect of two gases, the example of the simultaneous absorption/desorption of water vapor and SO2 is treated. ESA

N87-11422 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
INVESTIGATION OF THE APERIODIC BEHAVIOR OF THE SOUTHERN OSCILLATION USING METHODS OF NONLINEAR SYSTEMS ANALYSIS [UNTERSUCHUNG DES APERIODISCHEN VERHALTENS DER SOUTHERN OSCILLATION MIT METHODEN DER NICHTLINEAREN SYSTEMANALYSE] c46
Andreas Hense *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 135-136 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A method for the analysis of measured time series of the Southern Oscillation (SO) was developed in order to explain the aperiodic, chaotic behavior of the SO. The time evolution of the system with n components (degrees of freedom) is described by points in an abstract n-dimensional phase space. When all trajectories coincide (for time tending to infinity), this multitude is called an attractor. The method was applied to time series of the

monthly means of soil pressure, precipitation, and water surface temperatures. The results show that the aperiodic behavior of the SO can be explained by the existence of a singular attractor of fractional dimension 4.2. The method gives no hints as to which variable is dominating, and thus gives no contribution to the physical understanding of the SO. The method only provides an additional verification aid for the modeling of the SO. ESA

N87-11423 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE VENTILATION OF THE WARM WATER SPHERE IN THE NORTH ATLANTIC OCEAN [DIE VENTILATION DER WARMWASSERSPHAERE IM NORDATLANTIK] c48
G. Siedler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 137-140 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The ventilation of water and its significance for the coupled system ocean-atmosphere and for short term climate variations was studied. Ventilation was considered in the general sense of water renewal with changes in the state variables temperature, salt content, and concentration of other dissolved substances. Water renewal in winter is described; the warm water sphere consists of a surface layer with a typical thickness between 20 and 50 m. Transport and mixing below the surface layer are discussed. The dominating time scales for the interaction between atmosphere and ventilated water layers are presented. ESA

N87-11424 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE DEVELOPMENT OF THE SUBTROPICAL MODE-WATER, SIMULATED USING A SURFACE LAYER INTEGRATED ALONG A TRAJECTORY [DIE ENTSTEHUNG DES SUBTROPISCHEN MODE-WASSERS, SIMULIERT MIT EINEM ENTLANG EINER TRAJEKTORIE INTEGRIERTEN DECKSCHICHTMODELL] c48
Wolfgang Barkmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 141-142 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The formation of the subtropical mode-water (or 18C water) was simulated by Lagrangian integrations of a one-dimensional surface layer model. The model is an integral one of the Kraus-Turner type. The absorption of solar radiation in the ocean was calculated with parameterizations. The variation of the surface layer depth and the depths of chosen isopycnics along a trajectory were calculated. The variation along a trajectory of the difference between the yearly maximum surface layer depth of two consecutive years, and the yearly deepening along the trajectory of the surface layer by Ekman pumping are shown. The zone where the subtropical mode-water is formed during spring heating is shown. The inaccuracies of the surface fluxes and the trajectories, as well as the supposed barotropic flow limit the value of a quantitative prediction. ESA

N87-11425 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
DETERMINATION OF THE CIRCULATION IN THE NORTH ATLANTIC OCEAN FROM CLIMATOLOGICAL DATA [BESTIMMUNG DER ZIRKULATION DES NORDATLANTIK AUS KLIMATOLOGISCHEN DATEN] c48
Manfred Wenzel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 143-144 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A three-dimensional velocity field for the North Atlantic was determined using the modified beta-spiral method and a climatological data set for temperature and salinity. The method is based on the thermal wind relation and the geostrophic vorticity balance for the determination of the baroclinic part of the single momentum components. The resulting velocity field is essentially the classical representation of the circulation in the North Atlantic. Single flow bands are strongly spread out due to the climatological approximation to the mean of the data set. ESA

N87-11426 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE CORRELATION BETWEEN WIND AND THE TRAJECTORIES OF SATELLITE-POSITIONED DRIFT BUOYS [ZUR KORRELATION VON WIND UND DEN TRAJEKTORIEN SATELLITENGEORTETER TRIFTBOJEN] c48
Juergen Stahlmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 145-146 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Satellite-positioned drift buoys were used in the North Atlantic in order to examine the relation between wind and drift flow induced by wind. The parameters for the description of this relation are the deflection angle between wind direction and drift flow, and the relation between drift flow and wind shear. A correlation which is independent of the sea zone is obtained by choosing a suitable spectral window which only contains the frequency domain where wind is the only dominating excitation. The results agree with Ekman theory. It was possible to separate the energy maxima due to inertia oscillations and to tides. ESA

N87-11427 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
SATELLITE OBSERVATIONS OF ATMOSPHERICALLY DETERMINED CHANGES OF THE OCEAN SURFACE TEMPERATURE [SATELLITENBEOBACHTUNGEN ATMOSPHAERISCH BEDINGTER AENDERUNGEN DER OBERFLAECHENTEMPERATUR DES OZEANS] c48
Lothar Stramma *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 150-151 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Satellite observations in the IR domain were performed in order to study the heating of the sea surface temperature and the cooling after the passage of hurricanes in the western North Atlantic Ocean. Data taken from the NOAA-7 satellite were corrected for atmospheric effects and for the angle of inclination during the measurement. Comparisons with a temperature sensor 0.6 m under the sea surface were made in order to examine diurnal variations. Large diurnal variations occur in case of strong solar radiation and simultaneous weak wind force. Hurricanes were observed to cause an irreversible mixing of the ocean's surface and transition layers leading to a cooling of the surface layer. The combination of satellite observations and in situ measurements in the ocean is shown to be useful for the study of the interaction between atmosphere and ocean. ESA

N87-11428 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische.
A STATISTICAL METHOD FOR PREDICTION OF POLLUTANT EMISSION [EINE STATISTISCHE METHODE ZUR IMMISSIONSPROGNOSE] c45
Detlef Carius *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 152-153 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A statistical method for the prediction of air pollution was developed. The particle motions in an atmospheric turbulence field were approximately composed of piecewise rectilinear motions, the successions of which were statistically treated. The resulting general transport equation of the turbulent diffusion is solved with a Monte Carlo method, the advantages and disadvantages of which are discussed. Results show realistic distributions. ESA

N87-11429 Technische Univ., Munich (West Germany). Lehrstuhl fuer Bioklimatologie und Angewandte Mete.
THE ENERGY BALANCES OF SELECTED TYPES OF SURFACE IN THE MUNICH URBAN AREA [DIE ENERGIEBELANZEN VON

AUSGEWAEHLTEN OBERFLAECHENARTEN IM STADTGEBIET VON MUENCHEN]
Richard Amtmann and Helmut Mayer *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 154-155 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The energy balances of several urban surface types within the urban canopy layer were investigated. The energy balance equation of a surface contains the radiation balance, the soil heat flow, and the flow of sensible and latent heat. The diurnal variations of the different energy flows for a surface of the type meadow and one type of granite plate are discussed. ESA

N87-11430 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
NUMERICAL SIMULATION OF THE TURBULENT DIFFUSION ABOVE A ROUGH TERRAIN [NUMERISCHE SIMULATION TURBULENTER DIFFUSION UEBER UNEBENEM GELAENDE] c45
Michael Wamser and Hans-Dieter Haenel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 156-157 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A numerical model for the simulation of the propagation of pollutants in the atmosphere is presented. The normalized concentration distribution was simulated for a 120 m high source in the lee of a Gaussian hill; a general increase of the values in the soil is found compared to a flat terrain. This result qualitatively agrees with wind tunnel test results. The model results show that the Monte Carlo method is successful in complex flow situations, but needs an improved formulation of the turbulence parameters in case of inhomogeneous turbulence conditions. ESA

N87-11431 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
POSSIBLE FIELDS OF APPLICATION OF THE WIND TUNNEL FOR THE SOLUTION OF MICROMETEROLOGICAL PROBLEMS [EINSATZMOEGLICHKEITEN DES WINDKANALS BEI DER LOESUNG MIKROMETEOROLOGISCHER PROBLEME]
Michael Schatzmann, Gert Koenig, and A. Lohmeyer *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 158-159 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Wind tunnel tests were performed in order to provide an analog model of micrometeorological phenomena inside the atmospheric boundary layer. The wind velocity vector is parallel to the isobars and an equilibrium boundary layer at constant height can be made. The vertical velocity distribution can be reproduced, but the rotation of the wind vector with height cannot be realized. The boundary layer turbulence characteristics can be reproduced above a critical Reynolds number. ESA

N87-11432 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
DISPERSION OF ACCIDENTALLY RELEASED HEAVY GASES [AUSBREITUNG STOERFALLARTIG FREIGESETZTER SCHWERER GASE] c45
Gert Koenig and Michael Schatzmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 160-161 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Wind tunnel tests were performed for the physical modeling of the diffusion of accidentally released gases which are heavier than air. The modeling laws for the simulation of flow phenomena in wind tunnels were simplified for the case of a spontaneous release of a volume of heavy gas under standard conditions. Probes for the measurement of extremely fluctuating heavy gas concentrations were developed. Comparisons between model results and the results of field tests show good agreement. ESA

N87-11433 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
ICE ACCRETION DEPENDENCE ON CLOUD PHYSICAL PARAMETERS [DER EISANSATZ IN ABHAENGIGKEIT VON WOLKENPHYSIKALISCHEN PARAMETERN]
Hans-Eberhard Hoffmann and Roland Roth *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 162-163 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Ice deposition was investigated in order to determine flight limitations due to icing, and to verify forecasting methods and ice accretion models. A Do-28 aircraft was equipped for icing research to determine the cloud physical parameters, liquid water content, temperature, particle size, and particle phase. The effects of the icing-relevant cloud physical parameters on the accretion of ice below the Ludlam limit were determined by regression. ESA

N87-11434 Deutscher Wetterdienst, Offenbach am Main (West Germany).
ICE ACCRETION CALCULATIONS ON CYLINDRICAL RODS FOLLOWING THE BAIN MODEL, AND COMPARISON WITH EXPERIMENTAL RESULTS (FUCHS, SCHICKEL, KALUZA, UWIRA, 1985) [EISANSATZBERECHNUNGEN AN ZYLINDRISCHEN STAEBEN NACH DEM BAIN-MODELL UND VERGLEICH MIT EXPERIMENTELLEN ERGEBNISSEN]
Werner Fuchs *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 164- 165 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Measurements were performed from a DO-28 aircraft in zones of natural icing in order to determine the parameters required for the model of Bain (1950) which calculates the icing degree on cylindrical rods. These parameters are atmospheric pressure and temperature, size and number of cloud elements, flow velocity, and rod diameter. The Bain model simplifies a model for pure water clouds. Good agreement is found between calculated and measured icing velocities. ESA

N87-11435 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
THE INFLUENCE OF THE PLANETARY BOUNDARY LAYER ON THE VERTICAL STRUCTURE OF THE HORIZONTAL SIGHT UP TO A HEIGHT OF 300 M [DER EINFLUSS DER PLANETAREN GRENZCHICHT AUF DIE VERTIKALSTRUKTUR DER HORIZONTALSICHT BIS 300 M HOEHE] c46
Burkhard Pietzner *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 166-167 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The visual range was measured for the investigation of the effect of the planetary boundary layer on the visual profile and for the development of a horizontal visual climatology. The standard visual range was measured on a radio relay mast from fall 1982 till spring 1985 at a height of 2, 9, 80, 153, 223, and 297 m. The vertical structure of the visual range is determined by the vertical gradient of the aerosol concentration and on the relative humidity: both parameters depend on the dominating air masses and on the general weather situation. Rapid variations of the sight profile related to the formation and disintegration of mist, and to the passage of fronts were determined. The diurnal variation of the visual profile as a function of the general weather situation was determined. ESA

N87-11436 Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
OPERATIONAL MESOSCALE CEILING ANALYSIS AND FORECASTING USING STATISTICAL CLIMATOLOGICAL METHODS [OPERATIONELLE MESOSKALIGE CEILINGANALYSE UND -VORHERSAGE MIT HILFE STATISTISCH-KLIMATOLOGISCHER METHODEN]
Hans-Joachim Pistorius *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 168-169 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

An operational, objective, computer aided ceiling analysis method was developed. The analysis time points are the synoptic terms at distances of 3 hr each. The analysis domain covers a grid with 100 X 80 points and a mesh distance of 25 km. The grid orography contains 15 height steps. The ceiling analysis is based on the correction method. Preanalysis proves to provide a good first guess. The correction results from the difference between observation and first guess and is weighed as a function of the distance between range and grid point. The graphical presentation of the analysis, sensitivity experiments with different weightings, and an objective verification of the analysis are presented. Ceiling forecasting using first order Markov processes and principal components analysis is explained. ESA

N87-11437 Freie Univ., Berlin (West Germany).
THE INFLUENCE OF WEATHER-ACTIVE FRONTS ON VISUAL FLIGHT CONDITIONS [DER EINFLUSS VON WETTERAKTIVEN FRONTEN AUF SICHTFLUGBEDINGUNGEN]
Manfred Geb, Carsten Lindemann, and Werner Wehry *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 170-171 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Structured information describing the effects of weather-active fronts on visual flight conditions was provided. A potential cloud lower level and the effective ridge height of a wood were considered to determine dangerous levels of visual perception. The leeward and windward side are recognized. The results show that it is necessary to evaluate a broader set of cases with weather-active fronts, and to incorporate experiences of local weather advisers, fine-mesh radar data, and special flight measurements. ESA

N87-11438 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
HYDROLOGICAL BEHAVIOR PATTERN OF ISOLATED LAKES AND THEIR ROLE IN PALEOCLIMATOLOGY [HYDROLOGISCHE VERHALTENSMUSTER VON ABFLUSSLOSEN SEEN UND IHRE ROLLE IN DER PALAEOKLIMAFORSCHUNG]
L. J. Adams and G. Tetzlaff *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 172-173 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The amount of precipitation at isolated lakes was determined to study the paleoclimate. The terms of the water balance equation of a lake in a stable climate (no water level change) can be determined using suitable models. The estimation of the radiation balance is used to determine the evaporation and calculate the precipitation by iteration. Southern West Africa is an application region for paleoclimatological investigations. The application of the model to Lake Ine Kousamene together with several deduced, consistent meteorological and hydrological data shows that 9000 yr ago the precipitation (600 mm/year) was substantially higher then today (75 mm/year). ESA

N87-11439 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
MODELING OF MESOSCALE PROCESSES AT OCEANIC FRONTS [MODELLIERUNG MESOSKALIGER PROZESSE AN OZEANISCHEN FRONTEN]
Aike Beckmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 174-175 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The instability processes occurring at frontal jets were investigated using a quasi-geostrophic multilevel model. The growth rates of unstable frontal waves is shown to strongly depend on the given vertical structure of the flow field. The essential dynamic processes in the fronts appear to be correctly treated in the model. The flow field structure explains meridional heat transfer due to baroclinic instability. ESA

N87-11440 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SMALL SCALE AND SHORT TERM VARIABILITY OF GLOBAL RADIATION IN THE FEDERAL REPUBLIC OF GERMANY [KLEINRAEUMIGE UND KURZZEITIGE VARIABILITAET DER GLOBALSTRAHLUNG IN DER BUNDESREPUBLIK DEUTSCHLAND] **c46**
H. D. Behr *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date) p 176-177 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Methods for the estimation of small scale and short term deviations from the mean values obtained by the global radiation measuring network are presented. This estimation is necessary for solar energy plants because the density of the station network and the time resolution of the measured data cannot arbitrarily be increased. Mean diurnal variations and standard deviations of the hourly sums of the global radiation; mean annual variations of the radiation asymmetry morning-afternoon; and the correlation between the daily sum of global radiation in two stations are shown. ESA

N87-11441 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
VERIFICATION OF A CUMULUS-CONVECTION PARAMETERIZATION USING DATA SETS FROM TROPICAL AND MEDIUM LATITUDES [VERFIKATION EINER KUMULUS-KONVEKTIONSPARAMETRISIERUNG UNTER VERWENDUNG VON DATENSAETZEN AUS TROPISCHEN UND MITTLEREN GEOGRAPHISCHEN BREITEN]
Helga Behr *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 178-179 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A scheme for the parameterization of cumulus convection was tested using two data sets. The data was taken in the tropical eastern Atlantic (composite easterly waves) during GATE 1974 and during a cold air outbreak above the North Sea in the KONTUR 1981 experiment. The influence of the convective processes on the large scale environment was investigated by heat budget analyses. The observed data and the simulated results agree in both cases. ESA

N87-11442 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
BOUNDARY LAYER INVESTIGATIONS AND AEROLOGICAL MEASUREMENTS AT THE ANTARCTIC RESEARCH STATION GEORG VON NEUMAYER [GRENZSCHICHTUNTERSUCHUNGEN UND AEROLOGISCHE MESSUNGEN AN DER ANTARKTISFORSCHUNGSSTATION GEORG VON NEUMAYER]
H.-J. Belitz, H.-U. Stuckenberg, and Ch. Kottmeier *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 180-181 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The atmosphere including the Antarctic snow surface, and the

ground level boundary layer up to a height of 25 km was investigated. The characteristic boundary layer parameters were determined from measurements of wind velocity, wind direction, air temperature, air humidity, atmospheric pressure, insolation, global radiation, reflected short-wave radiation, and radiation budget. Aerological measurements were performed during radiosonde ascents. The pronounced temperature inversion in the lower troposphere during wintertime, due to radiation losses of the snow surface was clearly observed; a marked tropopause was not observed. Only a very weakly pronounced temperature inversion occurs during summertime; the tropopause is markedly present. The cooling of the stratosphere is substantially less pronounced in winter than in summer. ESA

N87-11443 Deutscher Wetterdienst, Offenbach am Main (West Germany). Abteilung Klimatologie.

CLIMATOLOGICAL DATA OF THE FEDERAL REPUBLIC OF GERMANY [KLIMADATEN DER BUNDESREPUBLIK DEUTSCHLAND]

J. Behrendt and B. Benesch *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 182-183 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The activities of the German weather service are reviewed. The historical evolution of meteorological measurements since the mid 18th century is depicted. The archives of meteorological data and the data processing systems are described. The computer-aided information systems for the documentation of all climatological and climate-relevant data are explained. ESA

N87-11444 Kiel Univ. (West Germany). Inst. fuer Meereskunde.

LOCAL OPTIMAL DETERMINATION OF THE WIND FIELD ON SEA FROM WIND AND PRESSURE OBSERVATIONS USING AN INVERSE METHOD [LOKAL OPTIMALE BESTIMMUNG DES WINDFELDES AUF SEE AUS WINDUND DRUCKBEOBACHTUNGEN MIT EINER INVERSMETHODE]

Ulla Ennenga and Lutz Hasse *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 184-185 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A method for the high-resolution analysis of wind fields on the basis of synoptic ground observations was developed. The method, which was applied to the North Atlantic Ocean, is based on a local optimization via the adjustment of pressure and wind data with polynomial planes using a boundary layer relation. A local measure of the reliability of the analysis characterizes uncertainties due to the asymmetrically varying data distributions. This analysis reduces the rms deviation between independent observations and analyzed fields. The systematic error of the mean wind velocity is also lower after adjustment. The method allows in a relatively simple way to take into account wind data of different systems with consideration of a weighting corresponding to the accuracy of the data. ESA

N87-11445 Hamburg Univ. (West Germany). Inst. fuer Meereskunde.

SYNOPTIC FLOW FIELDS IN FRONT OF THE NORWEGIAN WEST COAST, MEASURED WITH A HIGH FREQUENCY RADAR [SYNOPTISCHE STROEMUNGSFELDER VOR DER WESTKUESTE NORWEGENS, GEMESSEN MIT EINEM HOCHFREQUENZ-RADAR]

Heinz-H. Essen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 186-187 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

Radar measurements were performed in the Norwegian channel using the measuring system Coastal Oceanic Dynamics Application Radar (CODAR). The wavelengths of the utilized decametric waves correspond to those of the motion of the sea and of the surface flows which effect this motion. The measuring system uses the backscattered HF waves. The Doppler shift is determined by the phase velocity of the scattering sea waves. The CODAR system consists of two radar stations which measure the radial flow component. The spatial resolution is 3 km; the vertical and time approximation to the mean is 0.5 m and 18 min respectively. The CODAR measurements, performed in parallel with hydrographic investigations show complicated flow patterns with several vortices occurring during a measuring period. ESA

N87-11446 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.

CANALIZATION OF THE ATMOSPHERIC FLOW THROUGH VALLEYS [KANALISIERUNG DER ATMOSPHAERISCHEN STROEMUNG DURCH TAELER] c46

Franz Fiedler and Stefan Emeis *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 190-191 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

Numerical simulations were performed using a two-dimensional mesoscale model in order to investigate for which land dimensions the transition from a canalization parallel with the valley to a rotational flow can be expected. The model is nonhydrostatic and takes into account the orography as boundary condition via a coordinate transformation. The model calculates the pressure resistance of typical land forms. An essential feature of the simulations is the strong canalization in the case of a broad (20 km) valley. The narrower the valley, the stronger the flow pattern is determined by the friction forces and thus the more the flow in the direction of the valley is reduced. ESA

N87-11447 Technische Hochschule, Darmstadt (West Germany). Inst. fuer Meteorologie.

CHANGE OF THE LOCAL CLIMATE BY DEFORESTATION. A NUMERICAL SIMULATION EXPERIMENT [VERAENDERUNG DES LOKALKLIMAS DURCH ABHOLZUNGEN - EIN NUMERISCHES SIMULATIONSEXPERIMENT]

Guenter Gross *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 192-193 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

Changes of the local climate due to large scale deforestation were investigated with the numerical model FITNAH. Flow and temperature conditions were calculated in two numerical experiments, with and without forest. The three dimensional, nonequilibrium calculations were performed for a calm, cloudless winter night. The results show that after complete deforestation the wind velocity increases, the ground level temperature decreases, and hence the danger of frost in the lower areas is enhanced. ESA

N87-11448 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

THE USE OF MICROCOMPUTERS FOR GLIDER WEATHER FORECASTING [MICROCOMPUTER-EINSATZ BEI DER SEGELFLUGWETTERBERATUNG]

Dietrich Heimann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 194-195 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The application of numerical methods to glider weather forecasting by the use of cheap and easily transportable microcomputers is discussed. A modular program system was developed to estimate the change of the vertical structure of temperature and humidity in consecutive steps. The different steps in the forecasting, namely large scale advection, heating (diurnal variation), and convective fluctuation (thermal bubble) are explained. Good experience was gained during glider competitions and convection measuring campaigns. ESA

N87-11449 Kiel Univ. (West Germany). Abteilung Maritime Meteorologie.
MEASUREMENTS IN THE GROUND LEVEL ATMOSPHERIC LAYER DURING THE EXPERIMENT PUKK [MESSUNGEN IN DER BODENNAHEN LUFTSCHICHT WAEHREND PUKK] c46
Gerd Hessler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 196-197 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Wind, temperature, and moisture profiles were measured above the Wadden Sea in the coastal experiment PUKK. The effects of the Wadden Sea on the meteorological parameters of the ground level atmospheric boundary layer were examined. It is shown that in the Wadden area tide-determined variations in the ground level boundary layer occur, in contrast with the free sea; these variations modify the turbulent fluxes. ESA

N87-11450 Deutscher Wetterdienst, Offenbach am Main (West Germany).
INCREASE OF THE DUST MASS CONTENT IN THE AIR OF HAMBURG (WEST GERMANY) [ANSTIEG DES STAUBMASSENGEHALTS DER LUFT IN HAMBURG] c45
U. Kaminski and P. Winkler *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 198-199 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The dust mass concentration increase, registered since 1975 over Hamburg was investigated. The measurement was performed using a radiometric method which determines particles with a radius greater than 5 microns. The measuring series was monitored by filter collectors. The meteorologically induced variations were eliminated for the trend investigations of the dust mass. The dust mass increased from 33 microg/cu m in 1976 to 60 microg/cu m in 1985. The number of incidences per year of a high diurnal average of aerosol mass, and the number density of large aerosol particles also increase. The influence of these increases are not localized due to the relatively long lifetime of the particles. The process responsible for the aerosol increase are discussed. ESA

N87-11451 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.
NUMERICAL SIMULATION OF PHOTOSMOG IN A DYNAMIC-KINETIC MODEL OF THE ATMOSPHERIC BOUNDARY LAYER [NUMERISCHE SIMULATION VON PHOTOSMOG IN EINEM DYNAMISCHE-KINETISCHEN MODELL DER ATMOSPHAERISCHEN GRENZSCHICHT] c45
G. Kramm and F. Herbert *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and our Environment 1986 p 200-201 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A one-dimensional meteorological-photochemical atmospheric boundary layer model (ABL) was developed for the numerical study of the production of photochemical smog. The model was used in the investigation of the turbulent vertical transport and the molecular-turbulent deposition of reactive trace gases as a function of temporally fluctuating photolysis takes and of internal and external conditions. The ABL-model, which largely corresponds to the Sasamori model, is explained. Compared with the latter model, the ABL-model shows smaller differences between calculated and measured values. The verification of the global ABL-model is not successful because suitable vertical profiles of wind, temperature, moisture, and trace gases are not available. ESA

N87-11452 GKSS-Forschungszentrum Geesthacht (West Germany).
TEST OF A SIMPLE CLOUD MODEL WITH PRECIPITATION
L. Levkov and D. Eppel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 202-203 (For primary document see N87-11367 02-47)
Avail: Issuing Activity

A cloud parameterization model was incorporated into a three-dimensional hydrostatic mesoscale model for numerical testing. Most of the test conditions follow the Beniston numerical model which solves large scale prediction equations for momentum, heat, and humidity which are linked by an equation of state and a continuity equation; the inelastic approximation is used for mass conservation. Simulations shiow that the proposed scheme well describes the developing, mature, and decaying stage of cumulus clouds. In spite of the strong sensitivity of the mesoscale model to changes in the cloud variables, qualitative agreement in the time evolution of the convection situation is found between calculated and experimental results. ESA

N87-11453 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
DEVELOPMENT OF VORTEX ROLLS IN CASE OF COLD AIR OUTBREAKS ABOVE THE SEA. A NUMERICAL STUDY [ENTWICKLUNG VON WIRBELROLLEN BEI KALTLUFTAUSBRUECHEN UEBER DEM MEER - EINE NUMERISCHE FALLSTUDIE]
Siegfried Raasch *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 204-205 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The development of vortex rolls which accompany pronounced cloud streets was studied with a two-dimensional numerical model which does not take moisture into account. The investigation of the influence of inversions on the vortex development shows that the lowering of the inversion height slows down the purely dynamically determined vortex development, and that below a certain height the development stops. The comparison between model calculations and observations for the case of a cold air outbreak above the Bering Sea shows good agreement, and demonstrates that the vortex rolls are not only determined by a dynamic instability of the ground flow. ESA

N87-11454 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
NEWS ABOUT THE VISIBILITY OF SIGNAL LIGHTS UNDER THE INFLUENCE OF THE ATMOSPHERE [NEUES ZUR SICHTBARKEIT VON SIGNALLICHT UNTER DEM EINFLUSS DER ATMOSPHAERE] c74
G. H. Ruppersberg *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 206-207 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

The identification of signal lights in the atmosphere was studied. The required threshold intensities of signal lights calculated with Allard's law are only valid up to viewing angles of 0.5 min arc or adaptation luminances of 0.01 cd/sqm. ESA

N87-11455 European Space Agency. European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL EVALUATION OF METEOSAT DATA [OPERATIONELLE AUSWERTUNG VON METEOSAT-DATEN]
J. Schmetz, V. Gaertner, B. Mason, and O. Turpeinen *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 210-211 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Fully automatically deduced METEOSAT results and their utilization possibilities are presented. Consecutive rectified IR photographs are used to determine wind vectors; their is good agreement with rawinsonde observations in the lower troposphere. The water surface temperature is deduced from the IR radiation density for clear areas, and compared with ship observa-

tions for calibration. The cloud analysis is based on a histogram analysis of three channels and provides three cloud levels per segment; this analysis can be used to objectify and automate the estimation of vertical moisture profiles. The moisture of the upper troposphere is calculated from the radiation density measurement in the water vapor channel, and can be used for the initialization of numerical models. The climate data set is suited for climatological studies and for the calculation of the radiation budget at the upper atmosphere boundary. The precipitation index is also determined. ESA

N87-11456 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

MODEL CALCULATIONS OF THE THERMALLY INDUCED MESOSCALE MOUNTAIN WIND CIRCULATION [MODELLRECHNUNGEN ZUR THERMISCH INDUZIERTEN MESOSKALIGEN GEBIRGSWINDZIRKULATION] c46

F. Somieski and H. Mannstein *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 212-213 In GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N87-11367 02-47)

Avail: Issuing Activity

A hydrostatic mesoscale model was used to describe thermally induced mountain wind circulation systems. Model simulations for mountains with the horizontal scale of the Alps show the basic structure of the circulation and its sensitivity to variations of surface parameters such as roughness, albedo, and evaporation. For a smaller scale alpine region mountain and valley, winds in long valleys can be simulated realistically if the surrounding mountains are ascending towards the center of the mountains. Aircraft data showing surface temperatures as a function of terrain altitude and surface characteristics verify the model. ESA

N87-11457 Kiel Univ. (West Germany). Inst. fuer Meereskunde.

ANALYSIS OF MESOSCALE TEMPERATURE AND TURBIDITY FIELD [ANALYSE VON MESOSKALIGEN TEMPERATUR- UND TRUEBUNGSFELDERN] c46

Thomas Viehoff *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 214-215 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The kinematic structures in the ocean surface layer were analyzed using a remote temperature and turbidity measurements. This combination reduces the disadvantages of IR measurement with respect to the absorption of sea water. The data of the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA 7 satellite and the Coastal Zone Color Scanner on the NIMBUS 7 satellite were analyzed for the North Atlantic. The sea surface temperature was determined using the IR channels of the AVHRR, the turbidity was determined by the blue/green ratio. The temperature distribution shows stepwise subpolar fronts with meanders of 140 km; the blue/green ratio shows a clear frontal structure. Regional negative correlations between temperature and blue/green ratio occur. ESA

N87-11458 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie und Klimaforschung.

OROGRAPHIC INFLUENCE ON REGIONAL FLOW CONDITIONS, THE EXAMPLE OF THE NEUWIEDER BASIN. NUMERICAL SIMULATIONS [OROGRAPHISCHE BEEINFLUSSUNG VON REGIONALEN STROEMUNGSVERHAELTNISSEN AM BEISPIEL DES NEUWIEDER BECKENS -NUMERISCHE SIMULATIONEN] c46

Bernhard Vogel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 216-217 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The air flow conditions in the Neuwieder basin were calculated for different geostrophic flow directions using the nonhydrostatic numerical simulation model FITNAH. The results are represented as simulated trajectories which are exemplary for particular locations and starting heights. They show the modifications of the flow field due to the orography. These modifications are of special interest in relation with the propagation in topographically structured regions. Since three-dimensional fields of the turbulence characteristics result simultaneously from the simulations, it is possible to calculate transport and dilution of air admixtures using a Lagrangian propagation model. ESA

N87-11459 Institute for Meteorology and Water Economy, Cracow (Poland). Inst. fuer Meteorologie und Wasserwirtschaft.

EVOLUTION OF SODAR ECHOES AS A CLIMATOLOGICAL CHARACTERISTIC OF THE BOUNDARY LAYER [VERLAEUFE VON SODAR-ECHOS ALS KLIMATOLOGISCHE CHARAKTERISTIK DER GRENZSCHICHT] c46

Jacek Walczewski *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 218-219 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

The information given by the evolution of the backscattered signal (atmospheric echo) of acoustic radar is discussed. The registered signals can have several characteristic forms with four main types, vertical (convective) echoes, horizontal ground level echoes, high altitude horizontal echoes in the absence of lower layers (the free inversion layer), and structures without echoes. This classification can be applied for each hour of observation and can be used to digitize echograms. For a given type of sodar the peak height of the convective echoes is a relative measure for the convection intensity and the depth of the mixing layer. The characteristic forms of the second and the third type can be used to determine the duration of inversion layers. ESA

N87-11460 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

THE VARIABILITY OF SEA SURFACE TEMPERATURES [ZUR VARIABILITAET VON MEERESOBERFLAECHENTEMPERATUREN] c48

Karl-Heinz Weber *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 220-221 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

Long term trends in the sea surface temperature were studied. Maritime meteorological routine observations from ships are available since the mid 19th century; a global data set is available. Like the Northern Hemisphere air temperatures, the water temperatures also show a heating of 0.5 to 0.8 K/50 yr at tropical and medium latitudes of the Atlantic Ocean, but with a shift of 10 to 15 yr. The systematic errors due to varying measuring methods are discussed. ESA

N87-11461 Technische Univ., Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.

STATISTICS OF WIND SHEAR DUE TO NOCTURNAL BOUNDARY LAYER JET AIRSTREAMS IN NORTH GERMANY [EINE STATISTIK DER MIT NAECHTLICHEN GRENZCHICHTSTRAHLSTROEMEN VERBUNDENEN WINDSCHERUNG IN NORDDEUTSCHLAND]

K.-P. Wittich, J. Hartmann, and R. Roth *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 222-223 In GERMAN (For primary document see N87-11367 02-47)

Avail: Issuing Activity

Shear wind statistics were prepared for air traffic safety. The shear statistics are based on 14 nocturnal wind profiles. These nights were characterized by a boundary layer jet airstream whose wind maximum was 1.5 times the geostrophic ground wind, or even higher. Wind and temperature profile measurements with a 5 m vertical resolution were performed. It is shown that the

nocturnal stabilization of the ground level atmosphere and the formation of a boundary layer jet stream cause an increase of the wind shear. Increasing temperature gradients cause increased shear within certain limits. Strong time variations of wind field and temperature gradients are correlated with high shear. ESA

N87-11462 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SATELLITE MEASUREMENTS OF THE CLOUDINESS AND THE GLOBAL RADIATION FOR GLOBAL STATISTICS [SATELLITENMESSUNGEN DER BEWOELKING UND GLOBALSTRAHLUNG FUER EINE GLOBALE STATISTIK] c43
E. Raschke, F. Diekmann, A. Gratzki, J. Jacobs, M. Rieland, and H. J. Lutz *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 224-227 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

Suitably reduced data sets were made up in the International Satellite Cloud Climatology Project (ISCCP) in order to provide global statistical data about meteorological satellite pictures of cloud cover and global radiation at the soil. Multispectral IR data from NOAA-satellites are available for cloud identification. The high inverse correlation between the reflection and transmission power of cloud fields for solar radiation can be applied using satellite photographs to calculate the global radiation reaching the soil. ESA

N87-11463*# Massachusetts Inst. of Tech., Cambridge. Hydrology and Water Resource Systems.
SPATIAL ANALYSIS OF STORM DEPTHS FROM AN ARIZONA RAINGAGE NETWORK
Neil M. Fennessey, Peter S. Eagleson, Wang Qinliang, and Ignacio Rodriguez-Iturbe Aug. 1986 206 p
(Grants NAG5-388; NSF ATM-84-20781)
(NASA-CR-177186; NAS 1.26:177186; R86-21; Rept-306) Avail: NTIS HC A10/MF A01 CSCL 04B

Eight years of summer rainstorm observations are analyzed by a dense network of 93 raingages operated by the U.S. Department of Agriculture, Agricultural Research Service, in the 150 km Walnut Gulch experimental catchment near Tucson, Arizona. Storms are defined by the total depths collected at each raingage during the noon-to-noon period for which there was depth recorded at any of the gages. For each of the resulting 428 storm days, the gage depths are interpolated onto a dense grid and the resulting random field analyzed to obtain moments, isohyetal plots, spatial correlation function, variance function, and the spatial distribution of storm depth. Author

N87-11464# Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco, Calif.
TROPICAL CYCLONE REPORT, 1985 Annual Report, Jan. - Dec. 1985
1985 285 p
(AD-A168284) Avail: NTIS HC A13/MF A01

This annual report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a combined USAF/USN organization. The mission of the JTWC is multi-faceted and includes: (1) continuous monitoring of tropical weather activity in the Northern and Southern Hemispheres, from 180 degree longtitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alterts when tropical cyclon development is anticipated; (2)] issuing warnings on all significant tropical cyclones in the above area of responsibility; (3) determination of reconnaissance requirements for tropical cyclone surveillance and assignment of appropriate priorities; and, (4) post-storm analysis of all significant tropical cyclones occurring within the western North Pacific and North Indian Oceans, which includes an in-depth analysis of tropical cyclones of note and all typhoons. A summary of the South Pacific and South Indian Ocean significant tropical cyclones for 1 July 1984 - 30 June 1985 are included. GRA

N87-11465# Lawrence Livermore National Lab., Calif.
DESIGN AND USE OF ZONALLY-AVERAGED CLIMATE MODELS
M. C. MacCracken and S. J. Ghan Mar. 1986 46 p Presented at the North Atlantic Treaty Organization Advanced Study Institute on Physically-based Modeling and Simulation of Climate and Climatic Change, Erice, Sicily, 11 May 1986
(Contract W-7405-eng-48)
(DE86-008764; UCRL-94338; CONF-860591-1) Avail: NTIS HC A03/MF A01

Zonally-averaged climate models (ZACMs) provide a bridge from one-dimensional models such as energy-balance and radiative-convective models to three-dimensional general circulation models. Each type of model in this hierarchy involves particular simplifications, assumptions, and complexities in its development. As a consequence, each type of model presents particular advantages and disadvantages in investigation of questions of importance to better understanding of climate. While representation of the influence of horizontal eddies on the meridional climate structure presents special difficulties for a ZACM, the inclusion of latitudinal and altitudinal variations and the absence of synoptically-generated climatic variability permit the investigation of a range of climatic perturbations in which the forcing function is relatively small, latitudinally limited, or transient. DOE

N87-11466# Sandia National Labs., Albuquerque, N. Mex.
MINOR SCALE WEATHER-WATCH AND MICROBAROGRAPH PROJECT EXPERIMENTS 8620, 9415, 9416
J. W. Reed and H. W. Church 1986 141 p Presented at the Minor Scale Symposium, Albuquerque, N. Mex., 24 Feb. 1986
(Contract DE-AC04-76DP-00789)
(DE86-009641; SAND-86-0428C; CONF-860285-1) Avail: NTIS HC A07/MF A01

Predictions and measurements of distant airblast propagations were made to identify, control, and document the environmental impact from this large explosion. Special meteorological observations were made to support this as well as other experiments. Rawinsonde balloon upper-air observations were made to about 30 km altitude. Pilot balloons were tracked by optical theodolite to give frequent wind observations to about 3 km above ground. A Tethersonde balloon was operated to give details on atmospheric structure below about 3 km. Rocketsondes were launched to measure temperature and wind conditions at 35to 65-km heights, for explaining long range airblast propagations that focus near 200 km distance. A meteorological tower was set up to give continuous records of wind and temperature at three levels to 23 m height. An anemometer was installed near Ground Zero for reference during wind-sensitive helium bag operations. A weather advisory service was established, using WSMR observations as well as national weather data collections, and communicating through a computer terminal at the Stallion Radiosonde Station. Microbarograph (MB) airblast pressure recorders were operated at thirteen locations, from 3 km to 225 km from GZ. During the 10 days preceding MINOR SCALE, 31 ANFO charges, of 250 lb or 2500 lb yields, were fired to document the long range airblast propagation with MB recordings and upper air weather observations. DOE

N87-11467# Oregon State Univ., Corvallis. Climatic Research Inst.
CHALLENGE OF DETECTING CLIMATE CHANGE INDUCED BY INCREASING CARBON DIOXIDE
W. L. Gates and M. C. MacCracken 1985 12 p Prepared in cooperation with LLNL, Calif.
(Contract W-7405-eng-48)
(DE86-009704; UCRL-15778) Avail: NTIS HC A02/MF A01

The framework that provides the basis for efforts to detect the climatic effects of increasing CO2 concentrations is discussed. As background, some of the characteristics of climate, how it has changed, and some of the factors that may play a role in inducing such changes are reviewed. This overview also introduces some of the terminology used in CO2-climate studies. DOE

N87-11468# Scripps Institution of Oceanography, La Jolla, Calif.
LONG-TERM CLIMATE CHANGE IN OBSERVED PHYSICAL PROPERTIES OF THE OCEANS
T. P. Barnett 1985 17 p
(Contract W-7405-eng-48)
(DE86-009706; UCRL-15775) Avail: NTIS HC A02/MF A01

Changes in key ocean variables have been poorly documented over space and time. Temperature, sea level, salinity, and density are each discussed in terms of their importance to the climate system and society, their measurement problems and the availability of data, and their time variability over recent decades. DOE

N87-11469# Massachusetts Univ., Amherst.
DATA BASES FOR ISOLATING THE EFFECTS OF THE INCREASEING CARBON DIOXIDE CONCENTRATION
R. S. Bradley and P. D. Jones 1985 25 p Prepared in cooperation with East Anglia Univ., England
(Contract W-7405-eng-48)
(DE86-009709; UCRL-15769) Avail: NTIS HC A02/MF A01

The history of instrumentally recorded temperature data is discussed and some of the limitations of the data and the methods used in deriving large-scale averages reviewed. Long-term precipitation and pressure data sets and their limitations are also discussed. Finally, data on volcanic aerosol loading of the atmosphere and solar irradiance variations are discussed. DOE

N87-11470# Lawrence Livermore National Lab., Calif.
CONSTRUCTING A COHERENT LONG-TERM GLOBAL TOTAL OZONE CLIMATOLOGY FROM THE BUV, MFR, AND SBUV/TOMS DATA SETS
J. S. Ellis and F. M. Luther Feb. 1986 11 p Presented at the 2d Conference on Satellite Meteorology: Remote Sensing and Applications, Williamsburg, Pa., 12 May 1986
(Contract W-7405-eng-48)
(DE86-009722; UCRL-93549; CONF-8605102-1) Avail: NTIS HC A02/MF A01

The backscatter ultraviolet spectrometer (BUV) aboard the NIMBUS 4 satellite provided global ozone data until mid-1977. The Total Ozone Mapping Spectrometer (TOMS) and Solar Backscattered Ultraviolet (SBUV) instrument aboard the NIMBUS 7 satellite began providing global ozone in November 1978. The only satellite derived global total ozone data available between the termination of the BUV data and the startup of the SBUV/TOMS data is that from the Multichannel Filter Radiometer (MFR) instrument aboard the Defense Meteorological Satellite Program (DMSP) series of satellites. The MFR and the SBUV/TOMS data are compared during the data overlap period in order to determine how well the MFR data might be used to represent the SBUV/TOMS and BUV data during the data gap period. DOE

N87-11471# World Climate Programme, Geneva (Switzerland).
REPORT OF THE COSPAR INTERNATIONAL WORKSHOP ON SATELLITE-DERIVED SEA SURFACE TEMPERATURES FOR GLOBAL CLIMATE APPLICATIONS
E. G. Njoku, ed. and E. P. McClain, ed. Feb. 1986 61 p Workshop held at Camp Springs, Md., 28-31 May 1985
(WCP-110; WMO/TD-93; ETN-86-97805) Avail: NTIS HC A04/MF A01; print copy available at WMO, Geneva, Switzerland

The state of the art of sea surface temperature determinations from satellites was reviewed, and recommendations on the steps necessary to meet the accuracy requirements of the World Climate Research Program were made. The requirements are particularly demanding, especially those for the Tropical Ocean and Global Atmosphere project, for which accuracies of 0.3 C are needed in the warmest regions of the tropical oceans. ESA

N87-11472# World Climate Programme, Geneva (Switzerland).
REPORT OF THE WORKSHOP ON GLOBAL LARGE-SCALE PRECIPITATION DATA SETS FOR THE WORLD CLIMATE RESEARCH PROGRAMME
Jan. 1986 61 p Workshop held at Camp Springs, Md., 24-26 Jul. 1985
(WCP-111; WMO/TD-94; ETN-86-97806) Avail: NTIS M A01; print copy available at WMO, Geneva, Switzerland

An implementation scheme for the use of satellite visible and infrared image data to obtain estimates of large-scale convective-type precipitation and the use of microwave data to obtain instantaneous rain rate measurements, to obtain global large-scale precipitation data sets from a combination of data sources was discussed. Ground-based techniques and data processing were considered. ESA

N87-11473# International Meteorological Inst., Stockholm (Sweden).
[ACTIVITIES REPORT IN METEOROLOGY] Annual Report, Jul. 1984 - Jun. 1985
Nov. 1985 57 p
(AR-84/85; ISSN-0349-0068; ETN-86-97854) Avail: NTIS HC A04/MF A01

Research in dynamic meteorology; chemical meteorology and biogeochemistry; and atmospheric physics is summarized. ESA

N87-11474# Royal Netherlands Meteorological Inst., De Bilt.
MEPRO: A VOLUME OF IMIS PROCEDURES FOR THE USE OF THE OPERATIONAL-METEOROLOGICAL PRACTICE [MEPRO: EEN BUNDEL IMIS-PROCEDURES TEN DIENSTE VAN DE OPERATIONEEL-METEOROLOGISCHE PRAKTIJK]
H. Daan and R. Ivens, ed. 31 Aug. 1984 19 p In DUTCH
(Rept-84-2; ETN-86-98049) Avail: NTIS HC A02/MF A01

A mother program MEPRO was developed in order to implement user codes in IMIS, for weather forecasting. Operation of MEPRO is outlined. ESA

N87-11475# Royal Netherlands Meteorological Inst., De Bilt.
A SIMPLE GUIDANCE FORECAST FOR 100 STATIONS IN EUROPE AS A SUPPORT FOR THE WEATHER REPORT FOR HOLIDAY COUNTRIES [EEN EENVOUDIGE GIDSVERWACHTING VOOR 100 STATIONS IN EUROPA ALS ONDERSTEUNING VAN 'HET WEERBERICHT VOOR DE VAKANTIELANDEN']
C. Lemcke, G. W. Brouwer, and R. Ivens, ed. 12 Sep. 1984 49 p In DUTCH
(Rept-84-4; ETN-86-98050) Avail: NTIS HC A03/MF A01

A holiday weather forecast was developed using statistical interpretation of the maximum temperature and the change of precipitation between 06 and 18 GMT. For each station a choice is made between a standard set of predictors. The perfect-prog method was used since it allows use of one equation per station for all forecast periods. The selection of the weather stations and the meteorological input data is explained. The forecast was verified using as the most important verification measure for the temperature the absolute error, and for the precipitation the Brier score. The temperature forecast is clearly better than the precipitation forecast which can only be marginally used. ESA

N87-11248# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
ILLUSTRATION OF WIND FIELD TIME AND SPACE STATISTICS DURING THE TOSCANE-T CAMPAIGN
R. Ezraty, P. Queffeulou, and M. Champagne *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 59-61 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11249# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
SEA WIND FLUCTUATIONS ANALYSIS
L. Lavanant, P. Queffeulou, and R. Ezraty *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 63-66 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11266# Commissariat a l'Energie Atomique, Algiers (Algeria).
MODELING OF THE RELATION BETWEEN AIR TEMPERATURE

AND SURFACE TEMPERATURE FOR THE SPATIAL EXTENSION OF SURFACE PARAMETER ANALYSIS MODELS [MODELISATION DE LA RELATION TEMPERATURE DE L'AIR/TEMPERATURE DE SURFACE EN VUE DE L'EXTENSION SPATIALE DES MODELES D'ANALYSE DES PARAMETRES DE SURFACE]

A. Abdellaoui *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 171-174 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N87-11476# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
REPORTS OF THE US - USSR WEDDELL POLYNYA EXPEDITION, OCTOBER-NOVEMBER 1981. VOLUME 8: COLLECTED REPRINTS Special Report
Stephen F. Ackley and Donna R. Murphy Mar. 1986 146 p (AD-A169346; CRREL-SR-86-6) Avail: NTIS HC A07/MF A01 CSCL 08/10

Contents: American and Soviet Expedition into the Southern Sea Ice in October and November 1981; The U.S.-U.S.S.R. Weddell Polynya Expedition; Winter Mixed Layer Entrainment of Weddell Deep Water; Thermohaline Stratification Below the Southern Ocean Sea Ice; Physical Oceanography during WEPOLEX-81; Nutrient Chemistry Program During WEPOLEX-81; Carbonate Chemistry During WEPOLEX-81; Carbon Dioxide Partial Pressure in Surface Waters of the Southern Ocean; The Weddell Gyre; Nutrient Depletion Indicates High Primary Productivity in the Weddell Sea; Zooplankton in the Weddell Sea; Sea Ice and Water Column Plankton Distributions in the Weddell Sea in Late Winter; Late Winter Chlorophyll a Distributions in the Weddell Sea; Siliceous Microfauna in Waters Beneath Antarctic Sea Ice; Antarctic Radiolaria in Late Winter/Early Spring: Weddell Sea Waters; Antarctic Sea Ice Microwave Signatures and Their Correlation with In Situ Ice Observations; Sea Ice Structure and Biological Activity in the Antarctic Marginal Ice Zone; Observations of Pack Ice Properties in the Weddell Sea; Physical, Chemical and Biological Properties of Winter Sea Ice in the Weddell Sea; Elemental Compositions and Concentrations of Microispherules in Snow and Park Ice from the Weddell Sea; Relative Abundance of Diatoms in Weddell Sea Pack Ice; Atmospheric Boundary-Layer Modification, Drag Coefficient, and Surface Heat Flux in the Antarctic Marginal Ice Zone. GRA

N87-11477# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
ADVANCED OCEAN COLOR MONITOR (OCM) FEASIBILITY STUDY, EXECUTIVE SUMMARY Final Report
G. Cerutti-Maori Paris ESA 13 Jul. 1983 36 p Partly in FRENCH and ENGLISH
(Contract ESA-5234/82-F-CF(SE))
(SNIAS-96-CA/LL/O; ESA-CR(P)-2253; ETN-86-98130) Avail: NTIS HC A03/MF A01

After a theoretical analysis of the radiometric and geometric performances of the ocean color monitor instrument and a comparative study of the different configurations, a choice is made to select the instrument characteristics better adjusted to the European Space Agency specifications. It is decided to limit the device to the measurement of the ocean color, abandoning the measurement of the ocean surface temperature. The detailed description of the selected configuration shows that it is compatible with the load of the ERS-2 satellite, having 62 kg mass, 90 W power consumption and a reliability greater than 0.8. ESA

N87-11302# Universite de Bretagne Occidentale, Brest (France). Lab. d'Oceanographie Physique.
AVHRR DATA PROCESSING FOR UTILIZATION IN DYNAMICAL OCEANOGRAPHY
V. Mariette and V. Verbeque *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 365-369 Sponsored by CNRS and Inst. Francais de la Recherche pour l'Exploitation de la Mer (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11303# Scripps Institution of Oceanography, La Jolla, Calif.
DOWNWARD LONG-WAVE IRRADIANCE AT THE OCEAN SURFACE USING SATELLITE DATA
C. Gautier and R. Frouin *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing Dec. 1985 p 371-374 (For primary document see N87-11238 02-43)
Avail: NTIS HC A25/MF A01

N87-11423 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE VENTILATION OF THE WARM WATER SPHERE IN THE NORTH ATLANTIC OCEAN [DIE VENTILATION DER WARMWASSERSPHAERE IM NORDATLANTIK]
G. Siedler *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 137-140 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11424 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE DEVELOPMENT OF THE SUBTROPICAL MODE-WATER, SIMULATED USING A SURFACE LAYER INTEGRATED ALONG A TRAJECTORY [DIE ENTSTEHUNG DES SUBTROPISCHEN MODE-WASSERS, SIMULIERT MIT EINEM ENTLANG EINER TRAJEKTORIE INTEGRIERTEN DECKSCHICHTMODELL]
Wolfgang Barkmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 141-142 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11425 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
DETERMINATION OF THE CIRCULATION IN THE NORTH ATLANTIC OCEAN FROM CLIMATOLOGICAL DATA [BESTIMMUNG DER ZIRKULATION DES NORDATLANTIK AUS KLIMATOLOGISCHEN DATEN]
Manfred Wenzel *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 143-144 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11426 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE CORRELATION BETWEEN WIND AND THE TRAJECTORIES OF SATELLITE-POSITIONED DRIFT BUOYS [ZUR KORRELATION VON WIND UND DEN TRAJEKTORIEN SATELLITENGEORTETER TRIFTBOJEN]
Juergen Stahlmann *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 145-146 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11427 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
SATELLITE OBSERVATIONS OF ATMOSPHERICALLY DETERMINED CHANGES OF THE OCEAN SURFACE TEMPERATURE [SATELLITENBEOBACHTUNGEN ATMOSPHAERISCH BEDINGTER AENDERUNGEN DER OBERFLAECHENTEMPERATUR DES OZEANS]
Lothar Stramma *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference

on the Global Climate and Our Environment 1986 p 150-151 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

N87-11460 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
THE VARIABILITY OF SEA SURFACE TEMPERATURES [ZUR VARIABILITAET VON MEERESOBERFLAECHENTEMPERATUREN]
Karl-Heinz Weber *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 220-221 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

51 LIFE SCIENCES (GENERAL)

N87-11478*# Management and Technical Services Co., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 8
Lydia Razan Hooke, ed., Mike Radtke, ed., Victoria Garshnek, ed., Ronald Teeter, ed., and Joseph E. Rowe, ed. (Library of Congress, Washington, D. C.) Oct. 1985 111 p
(Contract NASW-3676)
(NASA-CR-3922(09); NAS 1.26:3922(09)) Avail: NTIS HC A06/MF A01 CSCL 06C

This is the eighth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 48 papers recently published in Russian language periodicals and bound collections and of 10 new Soviet monographs. Selected abstracts are illustrated with figures and tables. Additional features include reviews of two Russian books on radiobiology and a description of the latest meeting of an international working group on remote sensing of the Earth. Information about English translations of Soviet materials available to readers is provided. The topics covered in this issue have been identified as relevant to 33 areas of aerospace medicine and space biology. These areas are: adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cosmonaut training, cytology, endocrinology, enzymology, equipment and instrumentation, exobiology, gastrointestinal system, genetics, group dynamics, habitability and environment effects, hematology, human performance, immunology, life support systems, man-machine systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, personnel selection, psychology, reproductive biology, and space biology and medicine. Author

N87-11479# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
EFFECTS OF LONG-TERM RADIOFREQUENCY RADIATION ON IMMUNOLOGICAL COMPETENCE AND METABOLISM Final Report, Jun. 1983 - Oct. 1985
Chung-Kwang Chou, James A. Clagett, Lawrence L. Kunz, and Arthur W. Guy May 1986 118 p
(Contract F33615-83-C-0620)
(AD-A169064; USAFSAM-TR-85-105) Avail: NTIS HC A06/MF A01 CSCL 06/18

Two groups of 20 rats were exposed 21 h/day for 6 and 12 mo, respectively, to 10-microsecond-pulsed 2450-MHz microwaves at 800 pps and 8-Hz modulation, at an average power density of .48 mW/sq. cm (SAR 0.15-0.4 W/kg) in circularly polarized waveguides. Equal numbers of rats were sham exposed. Effects seen in the previous study (elevated corticosterone level afer 6 wk exposure; increased B and T cells in rats at 13 mo exposure) were not replicated in this study. Quantitative immunological tests involving 70 parameters showed six different showed six different effects. Among them, increased hematopoietic progenitor cells in the marrow was the only consistent effect in both 6- and 12-mo exposed groups. In the second part of the study three groups of rats were exposed 21 h/day to 2450-MHz CW microwaves at an average SAR of 0, 2.5, 5, and 7.5 W/kg (10 rats each) under three environmental temperatures (17.8, 22.2, and 26.7 C) over three 6-wk periods. Metabolism--including body mass, food/water intake, oxygen consumption, and carbon dioxide production--was measured, and health profile and immunological response were monitored. Results show that the effects are highly dependent on exposure level and environmental temperature. GRA

N87-11480# Brookhaven National Lab., Upton, N. Y.
ANAEROBIC MICROBIAL TRANSFORMATIONS IN SUBSURFACE ENVIRONMENTS: HIGHLIGHTS
A. J. Francis Sep. 1985 15 p
(Contract DE-AC02-76CH-00016)
(DE86-008703; DOE/ER-0243) Avail: NTIS HC A02/MF A01

Anaerobic microorganisms under appropriate conditions affect trace metal dissolution and mobilization or immobilization in the subsurface environments by one or more of the following processes: (1) changes in pH and Eh (which affect the valence or ionic state of the metals and enhance their mobility in the subsurface environment by retarding the subsoil binding characteristics); (2) chelation or production of specific sequestering agents (solubilization and leaching of certain elements by microbial metabolites or decomposition products); and (3) bioaccumulation and release of metals due to remineralization elsewhere in the environment. DOE

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N87-11481*# Umpqua Research Co., Myrtle Creek, Ore.
A PROTOTYPE SPACE FLIGHT INTRAVENOUS INJECTION SYSTEM Final Report
Gerald V. Colombo May 1985 65 p
(Contract NAS9-16337)
(NASA-CR-171911; NAS 1.26:171911) Avail: NTIS HC A04/MF A01 CSCL 06E

Medical emergencies, especially those resulting from accidents, frequently require the administration of intravenous fluids to replace lost body liquids. The development of a prototype space flight intravenous injection system is presented. The definition of requirements, injectable concentrates development, water polisher, reconstitution hardware development, administration hardware development, and prototype fabrication and testing are discussed. B.G.

N87-11482# Army Research Inst. of Environmental Medicine, Natick, Mass.
PREDICTION OF THE METABOLIC COST OF EXERCISE FROM MEASUREMENTS DURING RECOVERY
Stephen Legg, J., Joseph Dziados, Robert Mello, James A. Vogel, and Tammy J. Doherty Mar. 1986 19 p
(AD-A168076; USARIEM-M-24/86) Avail: NTIS HC A02/MF A01 CSCL 06/16

This study was designed to determine if post exercise recovery measurements could be used to predict the oxygen uptake (VO2), minute ventilation (V sub E) and heart rate (HR) during exercise. VO2, V sub E and HR were measured in 11 healthy males during the last minute of treadmill running (at various exercise intensities ranging from light to maximal effort) and for each 15 second period during three minutes of standing recovery. For each variable measured, a least squares regression line was calculated from data collected during the interval between 15 and 60 seconds after cessation of exercise. The ability of the Y intercept of this line, denoted B sub O, to predict the observed last-minute exercise value, denoted Y sub O, was enhanced by one of two distinct methods. For VO2 and HR, a linear least squares regression between Y sub O and B sub O was used to calculate correction

co-efficients. The linear regression co-efficients of (B sub O - Y sub O) versus the slope (B sub 1) of the original regression line enhanced the prediction of the observed exercise level of V sub E. In a separate validation experiment using 6 different males, the mean predicted values for VO2, V sub E and HR differed from observed last minute exercise values. It is concluded that the equations described in this study, utilising data collected during the first minute of recovery from exercise, may be useful in estimating the metabolic cost of exercise. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N87-11483# Gulf and Western Applied Science Labs., Waltham, Mass.
RESEARCH IN THE AREA OF VISUAL SEARCH Final Report, 1 Jun. 1983 - 31 May 1986
Leonard F. Scinto Jun. 1986 7 p
(Contract DAAG29-83-C-0014)
(AD-A168923; ARO-20540.2-LS) Avail: NTIS HC A02/MF A01 CSCL 06/16

The research sought to explicate a model of human visual search activity and identify those variables that affect effective visual search. It was also possible to develop and enhance the hardware and software capabilities central to research in the area of visual information processing. This research also addressed significant methodological issues in the analysis of eye movement data. GRA

N87-11484# British Aerospace Public Ltd. Co., Bristol (England). Human Factors Dept.
THE EFFECTS OF TERRAIN CLUTTER ON OBSERVER BEHAVIOUR DURING SEARCH OF COMPLEX SCENERY
L. K. B. Holman Aug. 1982 32 p
(BAe-BT-13535; LR46994; ETN-86-97957) Avail: NTIS HC A03/MF A01

An experiment on visual search in complex scenes was conducted, using a technique for measuring eye movements. Results were used to devise a means to divide scenes into clutter and nonclutter regions. It is shown that 85% of fixations fall within the clutter regions. The ratio of fixation density in clutter versus nonclutter regions corresponds well with target acquisition performance and it is suggested that measures of clutter area and clutter distribution could be used in the prediction of search performance. A suite of programs for microcomputers was written as an aid to the analysis of eye movement studies. ESA

N87-11485# British Aerospace Public Ltd. Co., Bristol (England).
AIR-TO-GROUND TARGET ACQUISITION IN THE PRESENCE OF SENSOR VIBRATION
G. J. Dean Jan. 1983 43 p
(BAe-BT-14222; LR48619; ETN-86-97963) Avail: NTIS HC A03/MF A01

The effect of pitch and roll movements of an airborne sensor relaying information to a remote ground station, an observers' target detection ability was studied using a flight simulator. Such movements may be attributed to wind gusting or coupled vibration. Sixteen video films were shown to each observer and each film contained 15 target tanks to be located. Results show a definite, but not great, decline in the number of correct designations made as pitch and roll increase: from 368 targets correctly designated in the vibration-free condition, to 291 designated in the highest vibration condition. The number of incorrect designations increases as vibration becomes greater. The total number of designations made declines as vibration increases. ESA

N87-11486# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON ACTIONS DUE TO LACK OF INFORMATION
Bengt G. Lundberg 1985 19 p
(Rept-85-45; ETN-86-98475) Avail: NTIS HC A02/MF A01

The problem of making conclusions from representations of knowledge is analyzed. Conclusion-making due to lack of information is studied. The concepts of immediately available information, assumptionally inferable information, and constructively inferable information are introduced. It is shown that it is important to specify the assumptions that are made about a representation, in particular with respect to the conclusions that can be made from the representation. For constructively inferable information, it is shown that the lack of information can only be used to select which among a set of possible conclusions to make. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnoiogy; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N87-11487# Human Engineering Labs., Aberdeen Proving Ground, Md.
ANTHROPOMETRIC CONSIDERATIONS FOR A FOUR-AXIS SIDE-ARM FLIGHT CONTROLLER Final Report
William B. DeBellis and Kathleen A. Christ Feb. 1986 22 p
(AD-A168135; HEL-TN-2-86) Avail: NTIS HC A02/MF A01 CSCL 06/14

This report describes the physical conditions of a multiaxis side-arm flight controller and armrest which were selected as being comfortable by a sample of 77 nonpilot and pilot personnel. Data are presented for males and females, right- and left-handed personnel, pilots and nonpilots, and pilots wearing and not wearing chemical-biological (CB) protective gear. Generally, the comfort range for the various armrest and flight controller parameters, as selected by nonpilot, male personnel, is sufficiently broad to include the effects of gender, handedness, protective clothing, and pilot experience. GRA

N87-11488# California Univ., Los Angeles. Motor Control Lab.
CONTROLLING THE TEMPORAL STRUCTURE OF LIMB MOVEMENTS: A RESPONSE Interim Report, period ending Jun. 1985
Richard A. Schmidt May 1986 11 p
(Contract MDA903-85-K-0225; DA Proj. 2Q1-61102-B-74-F)
(AD-A169261; ARI-RN-86-67) Avail: NTIS HC A02/MF A01 CSCL 06/16

This report is a response to a recent article by Berkinblit, et.al., which suggested that motor-program models, in which a centrally programmed temporal structure was a key ingredient, seemed incorrect. In particular, Schmidt takes issue with their discussion of Fel'dman's (1974) mass-spring model which denies a central program for limb movement timing and amplitudes. Schmidt argues that evidence for unidirectional actions and sequential movements limits the utility of the mass-spring model. GRA

N87-11489# Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT OF AN EXPERT SYSTEMS COMPUTER PROGRAM FOR CONTROL PANEL DESIGN ENHANCEMENT
A. L. Franklin, P. J. Pelto, and B. A. Fecht May 1986 15 p Presented at the Personal Computers: Gas Industry Applications, Las Vegas, Nev., 18 Jun. 1986
(Contract DE-AC06-76RL-01830)
(DE86-012153; PNL-SA-14013; CONF-860658-1) Avail: NTIS HC A02/MF A01

The control panel is the principal human/machine interface and is a key system in assuring the safe and reliable operation of a gas industry facility. The majority of gas industry facilities use hardwired control and display systems. Many newer facilities (and some existing facilities) are installing computer-aided control and display systems. In work conducted for the Gas Research Institute,

Battelle Northwest has developed human factors guidelines for hardwired (DeSteese et al. 1982) and computer-aided (Fecht et al. 1985) control and display systems. The guidelines themselves represent only a fraction of the total information gained during this research activity. Recent developments in the area of artificial intelligence provide a novel means for transferring and sharing expertise gained in developing these guidelines. A proof of principle expert system has been developed to demonstrate the practicality of using an expert system to record and communicate information traditionally presented in manuals and reports. The nature of expert systems not only provides a convenient means for communicating abstract concepts such as expertise and insight, but it also provides aninteractive medium where user access becomes more conversation like. In essence, the manual becomes a mimic of the expert that compiled the information found in the manual. In addition, with an animated or smart manual, the manual itself can become involved in the panel design process by suggesting areas where additional design consideration may be justified. DOE

N87-11490# British Aerospace Public Ltd. Co., Bristol (England). Applied Optics Research Dept.
AN EXPERIMENTAL DESIGN FOR COLOUR SENSITIVITY IN TARGET ACQUISITION
P. L. Philips Dec. 1981 51 p
(BAe-BT-12489-Vol-1; LR46186-Vol-1; ETN-86-97955) Avail: NTIS HC A04/MF A01

An algorithm which represents color discrimination thresholds in a three-dimensional metric color space is described. It is suitable for the design of color sensitivity experiments with display systems. The well-established algorithm for the matching tolerances of large color patches (greater than or = 35 milliradians) was extended to include the effects of small targets down to 1 milliradian. Allowance is made for color vision deficiencies exhibited with normal observers when viewing small target sizes. Variations with target size are very relevant to tolerancing displays in military systems. Experiments to test assumptions made in estimating the magnitude of the algorithm's coefficients, particularly when considering the extrapolation of existing data to differing regions of color space, effects of localized chromatic adaptation of the observer, and the texture interaction between target and background are proposed. ESA

N87-11491# British Aerospace Public Ltd. Co., Bristol (England). Applied Optics Research Dept.
AN EXPERIMENTAL DESIGN FOR COLOUR SENSITIVITY IN TARGET ACQUISITION, VOLUME 2
P. L. Philips Dec. 1981 30 p
(BAe-BT-12489-Vol-2; LR46186-Vol-2; ETN-86-97956) Avail: NTIS HC A03/MF A01

Coefficients for a color discrimination algorithm; MacAdam's geodesic chromaticity diagram; a transformation of Noorlander's et al (1980) data; a transformation of axes for ellipsoid cross sections; 50% probability loci for fit to Noorlander data; and solving the color discrimination algorithm for particular luminance-chromaticity combinations or chromaticity planes are covered.ESA

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N87-11492# Defense Technical Information Center, Alexandria, Va.
AN ASSESSMENT OF CD ROM (COMPACT DISK READ ONLY MEMORY)
Karen J. Jacobson Jun. 1986 13 p
(AD-A169259; DTIC/TR-86/15) Avail: NTIS HC A02/MF A01 CSCL 09/2

Compact Disk Read Only Memory (CD ROM) is one of a group of optical disk that offers great information storage potential. CD ROM Technology uses a laser to burn (record) pits in the light sensitive surface of an optical or plastic coated disk. The typical 4.75 inch CD ROM disk offers enough storage capability to hold the contents of 1,200 standard 5.25 inch floppy disks. This report describes the current state-of-the-art and typical steps in preparing the CD ROM database, including data preparation (data indexing and reformatting), disk premastery, disk mastery, and mass replication. The strengths of CD ROM technology include high data storage density, relatively low costs for widely distributed databases, relatively high random access speeds, and disk durability and integration in the normal office environment. Limitations include the current high costs of premastering and mastering disks, and the lack of standardization among CD ROM producers. CD ROM is not an acceptable storage alternative for databases that are highly volatile, however an erasable optical disk is currently under development. GRA

N87-11493# Oak Ridge National Lab., Tenn.
DOCUMENTATION OF MATERIALS DATA FOR COMPUTER STORAGE AND RETRIEVAL
M. K. Booker 1986 38 p
(Contract DE-AC05-84OR-21400)
(DE86-009509; CONF-860722-11) Avail: NTIS HC A03/MF A01

Paradioxically, the biggest problem with computer data management systems is also the biggest advantage - that such systems allow huge amounts of data to be accessed in a convient fashion. The very mass of data that can be delivered through such systems can result in considerable confusion on the part of the user. A few of the considerations that designers and operators of computerized materials data bases must take into account in order to assure that their data bases are useful and efficient are discussed. In particular, the complex (but vital) problem of documenting and characterizing the data stored in computer data bases in such a fashion as to assure (as far as possible) proper understanding and use of the data by persons accessing the data bases will be examined. B.G.

N87-11494# Oak Ridge National Lab., Tenn.
CESAR RESEARCH IN INTELLIGENT MACHINES
C. R. Weisbin 1986 37 p Presented at the World Conference on Robotics Research, Scottsdale, Ariz., 19 Aug. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008226; CONF-860841-1) Avail: NTIS HC A03/MF A01

The Center for Engineering Systems Advanced Research

(CESAR) was established in 1983 as a national center for multidisciplinary, long-range research and development in machine intelligence and advanced control theory for energy-related applications. Intelligent machines of interest here are artificially created operational systems that are capable of autonomous decision making and action. The initial emphasis for research is remote operations, with specific application to dexterous manipulation in unstructured dangerous environments where explosives, toxic chemicals, or radioactivity may be present, or in other environments with significant risk such as coal mining or oceanographic missions. Potential benefits include reduced risk to man in hazardous situations, machine replication of scarce expertise, minimization of human error due to fear or fatigue, and enhanced capability using high resolution sensors and powerful computers. A CESAR goal is to explore the interface between the advanced teleoperation capability of today, and the autonomous machines of the future. DOE

N87-11495# Rome Univ. (Italy). Dipt. di Fisica.
THE ARRAY PROCESSOR WITH EMULATOR (APE) PROJECT: A COMPUTER FOR LATTICE QCD
P. Bacilieri (Istituto Nazionale di Fisica Nucleare, Bologna, Italy), N. Cabibbo, E. Marinari, G. Parisi, F. Costantini (Pisa Univ., Italy), G. Fiorentini, S. Galeotti, D. Passuello, R. Tripiccione, A. Fucci et al 13 Dec. 1984 17 p
(Nota-Interna-839; IFUP-TH-84/40; ETN-86-97936) Avail: NTIS HC A02/MF A01

A single instruction multiple data computer for studying lattice QCD is proposed. Although it can be used as a general purpose array processor controlled by the 3081/E, the hardware is optimized for lattice QCD. The theoretical speed is 1 Giga-Flop, i.e., 6 or 7 times faster than the Cray 1, and the memory can be expanded up to 0.5 Giga-byte. ESA

N87-11496# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
TUMULT: A DISTRIBUTED REAL-TIME MULTI-PROCESSOR SYSTEM
P. G. Jansen Apr. 1985 16 p
(INF-85-3; ETN-86-98160) Avail: NTIS HC A02/MF A01

A project to design and implement a modular extendible multiprocessor system in PASCAL is described. All memory is distributed and processors communicate in parallel via a fast and reliable local switching network instead of a shared bus. A distributed real time operating system is being designed and implemented, consisting of a multitasking subsystem per processor. Processes can communicate via a message passing mechanism. Communication links and processes are dynamically created and disposed of by the application. A distributed exception mechanism is offered to recover from malfunctioning of resources or processes. ESA

N87-11497# MATRA Espace, Toulouse (France). Espace Produits et Technologie.
HIGH SPEED PROGRAMMABLE PROCESSOR FOR USE ON BOARD SATELLITES Final Report
Paris ESA Aug. 1985 92 p
(Contract ESA-4960/81-NL-HP(SC))
(EPT/DI/006/GG/TT; ESA-CR(P)-2206; ETN-86-98090) Avail: NTIS HC A05/MF A01

A high speed programmable processor for satellite onboard image and signal processing and computation was developed. The architecture is an attempt to define a single programmable product which can efficiently replace dedicated logic for real-time on-board functions. Hardware, programming rules, definition of a flight model, evaluation through a specific application, and analysis of other typical applications are considered. State of the art and directions for future developments are discussed. ESA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

N87-11498 Royal Signals and Radar Establishment, Malvern (England).
THE USE OF VALUES WITHOUT NAMES IN A PROGRAMMING SUPPORT ENVIRONMENT
Margaret Stanley Nov. 1985 17 p
(RSRE-Memo-3901; BR98723; ETN-86-98008) Avail: NTIS HC A02

The use in Flex of structured filestores holding anonymous values, supported by a command language that uses capability values in preference to names is described. Capability values are context independent whereas names are context dependent. Structured edfiles, that can hold values as well as text, make it possible to keep values on filestore without naming them. Flex does not need to use naming conventions to show the type of an object. The Flex mode of any value can be displayed directly. Flex does not rely on naming conventions or on structured directories to indicate relationships. They are shown by keeping values in the same structured edfile or by using explicit relationships such as those provided between source text and compiled code and between modules. ESA

N87-11499 Royal Signals and Radar Establishment, Malvern (England).
ORWELLIAN PROGRAMMING IN SAFETY-CRITICAL SYSTEMS
Ian F. Currie 1984 13 p Presented at Conference on System Implementation Languages, Experience and Assessment, Canterbury, England, Aug. 1984; sponsored by International Federation of Information Processing Society, and International Federation of Operations Research Society
(RSRE-Memo-3924; BR99100; ETN-86-98012) Avail: Issuing Activity

The final refinement in the production of a critical program from an elementary language via a compiler to bits in the critical system is discussed. It is argued that existing languages are inherently unsuitable for this purpose since they allow freedoms of expression and thought which, although convenient, lead to misconceptions and obscurities. Orwellian programming should limit freedom of expression so that these tendencies are unthinkable by using a NewSpeak which permits only Good Thoughts. ESA

N87-11500# Kernforschungszentrum, Karlsruhe (West Germany). Projekttraegerschaft Fertigungstechnik.
PROCEEDINGS OF A SPECIALIZED SYMPOSIUM ON THE EVALUATION OF DESIGN AND APPLICATION OF MODERN MANUFACTURING TECHNOLOGIES
I. Bey, ed. and H. Mense, ed. Mar. 1986 172 p In GERMAN; ENGLISH summary Symposium held in Karlsruhe, West Germany, 12 Mar. 1986 Sponsored by BMFT
(KfK-PFT-119; ETN-86-97839) Avail: NTIS HC A08/MF A01

Industrial installation of CAD/CAM systems and the development of robotics and their periphery are presented. Practical experiences with the implementation of CAD/CAM in a medium size company are given. The results of two social scientific inquiries, one concerning CAM planning and control systems in machine building industry, and the other related to the planning process of robot application with its technical, organizational, and social implications are discussed. For individual titles, see N87-11501 through N87-11505.

N87-11501# Fraunhofer-Inst. fuer Systemtechnik und Innovationsforschung, Karlsruhe (West Germany).
FIRST RESULTS OF THE EVALUATION STUDY OF THE INDIRECT-SPECIFIC FUNDING OF THE OPERATIONAL UTILIZATION OF CAD/CAM SYSTEMS [ERSTE ERGEBNISSE DER WIRKUNGSANALYSE DER INDIREKT-SPEZIFISCHEN FOERDERUNG ZUR BETRIEBLICHEN ANWENDUNG VON CAD/CAM-

SYSTEMEN]
G. Lay, M. Boffo, J. Fix-Stern, U. Kuntze, F. Meyer-Krahmer, C. Bartel, St. Leonhardt, M. Muehlberg, I. Schinko, and V. Vogelmann *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 9-73 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

Funding of a program to instal CAD/CAM systems in small companies, especially manufacturers of machine tools, tools, and measuring components, is described. For two thirds of the projects the entreprises broke technologically new ground. ESA

N87-11502# Kernforschungszentrum, Karlsruhe (West Germany).
PRACTICAL EXPERIENCE WITH THE APPLICATION OF CAD/CAM TO A MEDIUM-SIZE COMPANY [PRAKTISCHE ERFAHRUNGEN MIT DEM EINSATZ VON CADCAM IN EINEM MITTELSTAENDISCHEN BETRIEB]
Maurer Soehne *In its* Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 75-83 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

The usefullness of CAD/CAM for small companies was tested. The support of the data processing of the sequence of operations in the CAM domain is clearly strengthened. An improvement of the stock control and the securing of the delivery times are obtained by the integration of inventory management in connection with the material housekeeping and the ordering system. The introduction of CAD in construction shows a marked improvement of the productivity. However, substantial rationalization can only be obtained if a basic organization is present. ESA

N87-11503# Soziologisches Forschungsinst. e.V., Goettingen (West Germany).
MANUFACTURING PLANNING IN MACHINE BUILDING FROM THE POINT OF VIEW OF MANAGEMENT AND WORKSHOP PERSONNEL [FERTIGUNGSSTEUERUNG IM MASCHINENBAU AUS DER PERSPEKTIVE VON UNTERNEHMENSLEITUNG UND WERKSTATTPERSONAL] **c31**
F. Manske *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 85-109 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

Results of an empirical investigation of the application of computer aided manufacturing planning systems in machine building companies are summarized. Two different management concepts were emphasized, total planning and control of the manufacturing sequence, and frame planning and control. The consequences of the implementation of the concepts for foremen, workers, and management personnel, as well as for company results are given. ESA

N87-11504# Fraunhofer-Inst. fuer Arbeitswirtschaft und Organisation, Stuttgart (West Germany).
EVALUATION STUDY OF THE INDIRECT-SPECIFIC FUNDING FOR THE DEVELOPMENT OF INDUSTRIAL ROBOTS, MANIPULATION SYSTEMS, AND THEIR INTELLIGENT PERIPHERY [WIRKUNGSANALYSE DER INDIREKT-SPEZIFISCHEN FOERDERUNG ZUR ENTWICKLUNG VON INDUSTRIEROBOTERN, HANDHABUNGSSYSTEMEN SOWIE ZUGEHOERIGER INTELLIGENTER PERIPHERIE] **c37**
R. Bruening, R. Friedrich, and V. Korndoerfer *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 111-141 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

Intended and nonintended effects of introducing robots in small companies were evaluated. Technology development and operational innovation processes were considered. The analysis shows that the program succeeded in reaching the firms. ESA

N87-11505# Fraunhofer-Inst. fuer Productionstechnik und Automatisierung, Stuttgart (West Germany).
TECHNICAL AND ORGANIZATIONAL CONCEPTS OF THE APPLICATION OF INDUSTRIAL ROBOTS AND MANIPULATION SYSTEMS (IR/HHS). EXPERIENCES OF THE CONSULTANT CENTER FOR INDUSTRIAL ROBOTS (BZI) [TECHNISCHE AND ORGANISATORISCHE KONZEPTION DES IR/HHS-EINSATZES. ERFAHRUNGEN DES BERATERZENTRUM INDUSTRIEROBOTER (BZI)] **c37**
Guenter Schiele *In* Kernforschungszentrum Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies Mar. 1986 p 143-166 In GERMAN (For primary document see N87-11500 02-61)
Avail: NTIS HC A08/MF A01

The results of a social inquiry concerning the planning process of robot application with its technical, organizational, and social implications are presented. The inquiry concentrated on small and medium size industries, and is based on the knowledge obtained in a study on humanized flexible automation systems. The evaluation shows that the potential significance of the implementation of industrial robots is generally recognized and accepted. ESA

N87-11506*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SURVEY OF FUNCTIONAL PROGRAMMING LANGUAGE PRINCIPLES
C. Michael Holloway Sep. 1986 86 p
(NASA-TM-89019; NAS 1.15:89019) Avail: NTIS HC A05/MF A01 CSCL 09B

Research in the area of functional programming languages has intensified in the 8 years since John Backus' Turing Award Lecture on the topic was published. The purpose of this paper is to present a survey of the ideas of functional programming languages. The paper assumes the reader is comfortable with mathematics and has knowledge of the basic principles of traditional programming languages, but does not assume any prior knowledge of the ideas of functional languages. A simple functional language is defined and used to illustrate the basic ideas. Topics discussed include the reasons for developing functional languages, methods of expressing concurrency, the algebra of functional programming languages, program transformation techniques, and implementations of functional languages. Existing functional languages are also mentioned. The paper concludes with the author's opinions as to the future of functional languages. An annotated bibliography on the subject is also included. Author

N87-11507*# Mandex, Inc., Falls Church, Va.
STUDY OF FAULT-TOLERANT SOFTWARE TECHNOLOGY Final Report
T. Slivinski, C. Broglio, C. Wild, J. Goldberg (SRI International Corp., Menlo Park, Calif.), K. Levitt, E. Hitt (Battelle Memorial Inst., Columbus, Ohio), and J. Webb Sep. 1984 155 p
(Contract NAS1-17412)
(NASA-CR-172385; NAS 1.26:172385) Avail: NTIS HC A08/MF A01 CSCL 09B

Presented is an overview of the current state of the art of fault-tolerant software and an analysis of quantitative techniques and models developed to assess its impact. It examines research efforts as well as experience gained from commercial application of these techniques. The paper also addresses the computer architecture and design implications on hardware, operating systems and programming languages (including Ada) of using fault-tolerant software in real-time aerospace applications. It concludes that fault-tolerant software has progressed beyond the pure research state. The paper also finds that, although not perfectly matched, newer architectural and language capabilities provide many of the notations and functions needed to effectively and efficiently implement software fault-tolerance. Author

N87-11508*# Software and Engineering Associates, Inc., Santa Ana Heights, Calif.
IMPROVED TWO-DIMENSIONAL-KINETICS COMPUTER PRO-

GRAM Quarterly Progress Report, 1 Jul - 30 Sep. 1984
1984 23 p
(Contract NAS8-35931)
(NASA-CR-179782; NAS 1.26:179782; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 09B

The objective of this research is to increase the analytical capability of the existing TDK/BLM computer program for performance of OTV thrust chambers. Areas which need further examination and improvement are the thick boundary layer inviscid core flow interaction and the related thrust loss calculation. To warrent highly accurate results the provision of the best available program input data is mandatory as well as the use of sophisticated modeling techniques to reduce computation time with advanced error control criteria. The simulation of wall shocks and Mach-shocks in addition to shocks induced by large concave wall curvature is essential since this interaction with each other produces flow field changes which in turn affect the nozzle performance. Author

N87-11509*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIPROCESSING THE SIEVE OF ERATOSTHENES Final Report
Shahid Bokhari Jun. 1986 27 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178131; ICASE-86-41; NAS 1.26:178131) Avail: NTIS HC A03/MF A01 CSCL 09B

The Sieve of Eratosthenes for finding prime numbers in recent years has seen much use as a benchmark algorithm for serial computers while its intrinsically parallel nature has gone largely unnoticed. The implementation of a parallel version of this algorithm for a real parallel computer, the Flex/32, is described and its performance discussed. It is shown that the algorithm is sensitive to several fundamental performance parameters of parallel machines, such as spawning time, signaling time, memory access, and overhead of process switching. Because of the nature of the algorithm, it is impossible to get any speedup beyond 4 or 5 processors unless some form of dynamic load balancing is employed. We describe the performance of our algorithm with and without load balancing and compare it with theoretical lower bounds and simulated results. It is straightforward to understand this algorithm and to check the final results. However, its efficient implementation on a real parallel machine requires thoughtful design, especially if dynamic load balancing is desired. The fundamental operations required by the algorithm are very simple: this means that the slightest overhead appears prominently in performance data. The Sieve thus serves not only as a very severe test of the capabilities of a parallel processor but is also an interesting challenge for the programmer. Author

N87-11510*# Illinois Univ., Urbana-Champaign. Software Systems Research Group.
EOS: A PROJECT TO INVESTIGATE THE DESIGN AND CONSTRUCTION OF REAL-TIME DISTRIBUTED EMBEDDED OPERATING SYSTEMS Mid-Year Report, 1986
R. H. Campbell, Ray B. Essick, Judy Grass, Gary Johnston, Kevin Kenny, and Vince Russo 4 Nov. 1986 205 p
(Grant NsG1-1471)
(NASA-CR-179874; NAS 1.26:179874) Avail: NTIS HC A10/MF A01 CSCL 09B

The EOS project is investigating the design and construction of a family of real-time distributed embedded operating systems for reliable, distributed aerospace applications. Using the real-time programming techniques developed in co-operation with NASA in earlier research, the project staff is building a kernel for a multiple processor networked system. The first six months of the grant included a study of scheduling in an object-oriented system, the design philosophy of the kernel, and the architectural overview of the operating system. In this report, the operating system and kernel concepts are described. An environment for the experiments has been built and several of the key concepts of the system have been prototyped. The kernel and operating system is intended to support future experimental studies in multiprocessing, load-balancing, routing, software fault-tolerance, distributed data base design, and real-time processing. Author

N87-11511*# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
PARALLEL PROCESSORS AND NONLINEAR STRUCTURAL DYNAMICS ALGORITHMS AND SOFTWARE Final Technical Report, 1 Mar. - 30 Oct. 1986
Ted Belytschko 7 Nov. 1986 35 p
(Grant NAG1-650)
(NASA-CR-179889; NAS 1.26:179889) Avail: NTIS HC A03/MF A01 CSCL 09B

A nonlinear structural dynamics program with an element library that exploits parallel processing is under development. The aim is to exploit scheduling-allocation so that parallel processing and vectorization can effectively be treated in a general purpose program. As a byproduct an automatic scheme for assigning time steps was devised. A rudimentary form of the program is complete and has been tested; it shows substantial advantage can be taken of parallelism. In addition, a stability proof for the subcycling algorithm has been developed. Author

N87-11512*# Texas A&M Univ., College Station. Telecommunication and Control Systems Lab.
PERFORMANCE ANALYSIS OF A CASCADED CODING SCHEME WITH INTERLEAVED OUTER CODE
Shu Lin 10 Nov. 1986 21 p
(Grant NAG5-778)
(NASA-CR-179869; NAS 1.26:179869) Avail: NTIS HC A02/MF A01 CSCL 09B

A cascaded coding scheme for a random error channel with a bit-error rate is analyzed. In this scheme, the inner code C sub 1 is an (n sub 1, m sub 1l) binary linear block code which is designed for simultaneous error correction and detection. The outer code C sub 2 is a linear block code with symbols from the Galois field GF (2 sup l) which is designed for correcting both symbol errors and erasures, and is interleaved with a degree m sub 1. A procedure for computing the probability of a correct decoding is presented and an upper bound on the probability of a decoding error is derived. The bound provides much better results than the previous bound for a cascaded coding scheme with an interleaved outer code. Example schemes with inner codes ranging from high rates to very low rates are evaluated. Several schemes provide extremely high reliability even for very high bit-error rates say 10 to the -1 to 10 to the -2 power. Author

N87-11513# Massachusetts Inst. of Tech., Cambridge. Dept. of Elec. Engineering and Computer Sciences.
SIGNAL PROCESSING AND INTERPRETATION USING MULTILEVEL SIGNAL ABSTRACTIONS
Evangelos E. Milios Jun. 1986 221 p
(Contract N00014-81-K-0742; Grant NSF ECS-84-07285)
(AD-A169166; TR-516) Avail: NTIS HC A10/MF A01 CSCL 09/2

This thesis advances multilevel signal abstractions as a useful conceptual framework in signal processing. More specifically, multilevel abstractions for one-dimensional harmonic spectra are developed and demonstrated to be useful in combining heuristics with algorithmic techniques in a variety of signal processing problems associated with real helicopter data, such as adjusting spectral estimation parameters and tracking fundamental frequency and power of helicopter spectra. Furthermore, multilevel abstractions for two-dimensional wavenumber spectra are used as the basis for a diagnosis system that searches for inappropriate parameter settings in an array processing system for direction determination. The diagnosis system illustrates the use of multilevel single abstractions in automating reasoning about complex signal processing systems. GRA

N87-11514# Yale Univ., New Haven, Conn. Dept. of Computer Science.
GAUSSIAN ELIMINATION ON HYPERCUBES
Youcef Saad Mar. 1986 17 p

(Contract N00014-82-K-0184)
(AD-A169293; YALEU/DCS/RR-462) Avail: NTIS HC A02/MF A01 CSCL 09/2

Several implementations of the Gaussian elimination algorithm for solving dense linear systems on hypercube parallel processors are compared. Two classes of methods, those that require moving the elimination row (or column) to all processors before the elimination proceeds, and those that require only moving data to the nearest neighbors. Algorithms of the second class, which are called pipelined algorithms, require only a ring or grid structure which is embedded into the hypercube. One of the main conclusions is that for Gaussian elimination the additional connectivity of the hypercube topology over a two dimensional grid of processors does not help much in improving efficiency. Another result of the analysis is that there is little reason for using row or column type algorithms instead of grid algorithms. One of the goals of the paper is also to show a simple model of complexity analysis at work, by comparing the estimated times that it provides with the actual execution times. GRA

N87-11515# Yale Univ., New Haven, Conn. Dept. of Computer Science.
A FAST ALGORITHM FOR PARTICLE SIMULATIONS
L. Greengard and V. Rokhlin Apr. 1986 25 p
(Contract N00014-82-K-0184)
(AD-A169294; YALEU/DCS/RR-459) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm is presented for the rapid evaluation of the potential and force fields in systems involving large numbers of particles whose interactions are Coulombic or gravitational in nature. For a system of N particles, an amount of work of the order O(N2) has traditionally been required to evaluate all pairwise interactions, unless some approximation or truncation method is used. The algorithm of this paper requires an amount of work proportional to N to evaluate all interactions to within roundoff error, making it considerably more practical for large-scale problems encountered in plasma physics, fluid dynamics, molecular dynamics and celestial mechanics. Author (GRA)

N87-11516# Illinois Univ., Urbana. Dept. of Computer Science.
REAL-TIME INTEGRATION FORMULAS WITH OFF-STEP INPUTS AND THEIR STABILITY
C. W. Gear and D. Wang Jun. 1986 22 p
(Contract DE-AC02-76ER-02383)
(DE86-011852; UIUCDCS-R-86-1277; UILU-ENG-86-1731; COO-2383-0123) Avail: NTIS HC A02/MF A01

In real-time integration, additional time delays can be introduced by the computer time needed to compute an output after the input has been sampled. These delays can be reduced by sampling the input between the output points rather than at the same time. The integration formulas have to be adjusted to reflect the off-step inputs. This paper discusses such formulas and examines their stability properties. DOE

N87-11517# Lawrence Livermore National Lab., Calif.
ARC-OLOGY VIA TELL-A-GRAF
D. Biggers 10 Mar. 1986 16 p Presented at the ISSCO Week, New Orleans, La., 10 Mar. 1986
(Contract W-7405-eng-48)
(DE86-009698; UCRL-94340; CONF-860363-3) Avail: NTIS HC A02/MF A01

This paper addresses the problem of drawing a circle or an arc, or bending text strings around arcs using TELL-A-GRAF software. ARC-OLOGY is a front-end to TELL-A-GRAF and was developed to solve this problem. With this (or a similar) capability the TELL-A-GRAF user will be more able to include circles, arcs and arched text in the design of logos, icons and other graphic representations. This paper describes the process by which the ARC-OLOGY front-end generates the necessary TELL-A-GRAF data. The capability is available via the Flop-Swap for both Nomad2 and dBASE III environments. However, for users desiring this capability in another environment, this description can also be used as basic specifications for an in-house developed front-end. DOE

N87-11518# Rolls-Royce Ltd., Derby (England).
A SUMMARY OF DO-178A
C. D. Jack and M. Bardill 6 Mar. 1986 5 p Presented at Institute of Electrical Engineers' Conference on Software for the Control of Gas Turbines, United Kingdom, 7 Feb. 1985
(PNR-90294; ETN-86-98013) Avail: NTIS HC A02/MF A01

Modifications to the document produced by the Radio Technical Commission for Aeronautics (RTCA) entitled Software Considerations in Airborne Systems and Equipment Certification, generally known as DO-178A (its document number), are outlined. These cover software levels, partitioning, verification assurance, coverage analysis, testing environment, configuration management, and quality assurance. ESA

N87-11519# Politecnico di Milano (Italy). Dipt. di Elettronica.
A PROPOSAL FOR A NEW SOFTWARE RELIABILITY MODEL AND ITS PRELIMINARY ASSESSMENT
Sergio Bittanti, Paolo Bolzern, Carlo Ghezzi, and Riccardo Scattolini 1986 21 p
(Rept-86-001; Rept-85-36; ETN-86-97937) Avail: NTIS HC A02/MF A01

A software reliability model which is described by a nonlinear differential equation of Riccati type is proposed. The model is an extension of Musa's model. It removes the hypothesis of nonindependent faults and is based on a simple assumption on the nature and structure of errors in a program. The model is validated with respect to experimental data. Parameters are estimated by a simple least squares method. ESA

N87-11520# British Aerospace Public Ltd. Co., Bristol (England). Guidance and Control Dept.
COMPUTER PROGRAM TRAMP: FURTHER EXTENSIONS
A. J. Clough 17 Jan. 1983 72 p
(BAe-BT-13621; LR47589; ETN-86-97958) Avail: NTIS HC A04/MF A01

The TRAMP program was extended to include an adjoint analysis, covariance analysis, calculation of the steady state Kalman gains, the steady state solution of the linear optimal regulator problem, and time responses in the state space analysis package. Changes and additions made to the nonlinear section of TRAMP are also outlined. ESA

N87-11521# Royal Netherlands Meteorological Inst., De Bilt.
THE IMIS PROGRAM NESO [HET IMIS-PROGRAMMA NESO]
H. M. deGier and R. A. A. M. Ivens 26 Mar. 1984 17 p In DUTCH
(Rept-84-1; ETN-86-98048) Avail: NTIS HC A02/MF A01

An interactive computer program for the determination of the kind of precipitation at temperatures around 0C is presented. The different parts of the program and its interactive character are explained. The different program tasks which the user can choose are presented. Manual input of the data, error detection, suggestions for practical use, and verifications of the method are explained. The value of the program for the forecasting of precipitation is discussed. ESA

N87-11522# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
ABSTRACT GRAMMARS BASED ON TRANSDUCTIONS
Peter R. J. Asveld Jun. 1985 26 p
(INF-85-13; ETN-86-98164) Avail: NTIS HC A03/MF A01

An abstract grammatical model in which the effect (or application) of a production, determined by a so-called transduction, plays the main part rather than the notion of production itself is studied. Under appropriately chosen assumptions on the underlying family T of transductions, elementary, decidability, and complexity properties of the corresponding family L(T) of languages generated by T-grammars are established. These results are special instances of slightly more general properties of so-called gamma-controlled T-grammars, since regular control does not increase the generating

power of T-grammars (in a gamma-controlled T-grammar the iteration of T-transductions is restricted to those sequences of transductions that belong to a given control language, taken from a family gamma of control languages). ESA

N87-11523# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
SOFTWARE TOOLS FOR THE DESIGN OF PROTOCOL SYSTEMS, PART 1 Thesis
Peter vanEijk Oct. 1985 47 p Sponsored by Commission of European Communities ESPRIT/SEDOS project
(INF-85-21; ETN-86-98170) Avail: NTIS HC A03/MF A01

A methodology for protocol systems with an application to Open Systems Interconnection; the concept of formal specification of behavior; and the way it is related to the design methodology are discussed. The functional requirements for an integrated set of tools for the support of the protocol system design process are outlined. Prototypical software structures, i.e., examples of the basic patterns in programs, are analyzed. The mechanisms required to implement the proposed tools are described. Simulation of LOTOS expressions and the feasibility of compilation of LOTOS (i.e., the generation of implementations of LOTOS specifications) and the problems of testing implementations are emphasized. ESA

N87-11524# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
DESIGN AND IMPLEMENTATION OF THE TUBA APPLICATION GENERATION SYSTEM
F. A. vanHoeve and R. Engmann Nov. 1985 54 p
(INF-85-23; ETN-86-98172) Avail: NTIS HC A04/MF A01

The design and implementation of the environments for file processing, screen handling, and report writing of the TUBA system are described. The TUBA system consists of a set of integrated tools for the generation of business oriented applications. The implementation is based on the programming language SIMULA67. Tools and applications have a modular structure, represented by SIMULA class objects. ESA

N87-11525# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Mathematische Verfahren und Datentechnik.
INTERACTIVE DATA ANALYSIS
Karl-Friedrich Doherr and Gerhard Wulff Jan. 1986 48 p
(DFVLR-Mitt-86-07; ISSN-0176-7739; ETN-86-98177) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany, DM 18

To help analyze test data on a mainframe computer, a FORTRAN package for interactive data analysis (DIVA) was developed. The DIVA runs under the operating system IBM 0S/VS2 MVS and requires a graphical workstation as terminal. As results, the user gets high resolution graphs of the time histories, Fourier coefficients, power spectra, amount of spectral energy, Fourier synthesis, autocorrelation function, class frequencies, frequency response, coherence function, and cross-plots. The theoretical background of the methods applied are presented together with practical examples. ESA

N87-11526# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
INTRODUCTION TO THE TOOLS FOR USER-FRIENDLY BUSINESS APPLICATIONS (TUBA) SYSTEM [INLEIDING IN HET TUBA-SYSTEEM]
F. A. vanHoeve and R. Engmann Nov. 1985 57 p In DUTCH
(INF-85-24; ISBN-90-365-0021-4; ETN-86-98173) Avail: NTIS HC A04/MF A01

A system which provides automated aids to enable the user (systems designers and programmers) to realize the desired data processing in a simple way is described. It is a generator of administrative applications. The modular structure of the application programs is described. Organization, definition and creation of inventories; creation and manipulation of screens; generation of batch programs and interactive programs; and report-writer functions are discussed. ESA

N87-11527# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON KARMARKAR'S PROJECTIVE METHOD FOR LINEAR PROGRAMMING
C. Roos 1985 66 p
(Rept-85-23; ETN-86-98458) Avail: NTIS HC A04/MF A01

A self-supporting and simplified exposition of the projective method of Karmarkar (1984) for linear programming, and computations with this method are presented. Results agree with Karmarkar's claim that the number of iterations grows on average as quickly as the logarithm of n. Comparing CPU-times, the Simplex method is superior to Karmarkar's method (30 to 50 times faster than the deep step versions of the projective method). If Karmarkar's method can be speeded up by a factor root n, using his modified version, the 2 methods may be competitive for large n (1600), but such modifications only apply to the small step version. A small linear programming problem for which Karamarkar is far more stable than Simplex is found. ESA

N87-11528# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Computer Science.
COMPUTER AIDED EDUCATION IN THE CHOCE OF STUDIES [COMPUTER ONDERSTEUND ONDERWIJS BIJ STUDIEKEUZE]
Charles vanderMast 1985 17 p In DUTCH
(Rept-85-29; ETN-86-98461) Avail: NTIS HC A02/MF A01

Computer aided education (CAE) was introduced to support the study choice process of the students. The motives for the application of CAE are outlined. The structure of the content of the CAE course INFO, as well as the development method in a multidisciplinary team using a prototype are described. Experience after the use of INFO by the students during one school year is discussed. ESA

N87-11529# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
TECHNIQUES FOR REDUCING BOOLEAN EVALUATION TIME IN CONSTRUCTIVE SOLID GEOMETRY (CSG) SCAN-LINE ALGORITHMS
W. F. Bronsvoort 1985 18 p
(Rept-85-43; ETN-86-98473) Avail: NTIS HC A02/MF A01

Techniques to reduce Boolean evaluation time in Atherton's (1983) scan-line hidden surface algorithms for combinations of plane-faced primitives for image generation of complex models were developed. A straighforward implementation of Atherton's algorithm with top-down Boolean evaluation; and Boolean evaluation done bottom-up with a pruned constructive solid geometry (CSG) tree, and with an extension to reduce the number of Boolean evaluations were tested. Results show that the time needed for Boolean evaluation in a CSG scan-line algorithm can be reduced by more than 90%, and the total drawing time by 65% to 80%. ESA

N87-11530# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
REAL TIME DEBUGGING SOFTWARE PACKAGE FOR FLIGHT SIMULATOR SOFTWARE SYSTEM WITH VARIABLE LABELED COMMON BLOCKS
H. W. G. deJonge 2 May 1985 18 p In DUTCH; ENGLISH summary Presented at the Netherlands Society for Informatics, and the Foundation Informatics Research in the Netherlands Symposium, Utrecht, Netherlands, 1-2 Apr. 1985
(NLR-MP-85013-U; B8667024; ETN-86-98489) Avail: NTIS HC A02/MF A01

The support of software development by the application of system defined variables is surveyed. The large software system consists of a large number of modules that share access to data in the direct addressable memory by the use of labeled common blocks in which variable names for addressing fields are used freely. It is proposed to introduce a common-definition file for the management of common variable names, defined on system level, in a similar way as a data dictionary is used for the management of data in data bases. A common-definition file can

be applied for the creation of consistent sources for compilation, interactive debugging, and selection of variables for monitoring and recording of data during program execution. A software system which applies access to such a common-definition files is operational.The system is used for software development in FORTRAN 5. ESA

N87-10889# Technische Hogeschool, Delft (Netherlands).
ABOUT THE DEVELOPMENT OF INTERACTIVE SHELL DESIGN CODES
Johann Arbocz *In* ESA Proceedings of an International Conference on Spacecraft Structures Apr. 1986 p 19-26 (For primary document see N87-10886 02-18)
Avail: NTIS HC A19/MF A01

N87-11045*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Microelectronics Technology Section.
ULYSSES: A FUNCTIONAL DESCRIPTION AND SIMULATION SOFTWARE SYSTEM
T. W. Griswold and D. F. Hendry *In its* The Telecommunications and Data Acquisition Report (date] p 193 - 202 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N87-11531# Yale Univ., New Haven, Conn. Dept. of Computer Science.
DATA COMMUNICATION IN PARALLEL ARCHITECTURES
Youcef Saad and Martin H. Schultz Mar. 1986 24 p
(Contract N00014-82-K-0184)
(AD-A169302; YALEU/DCS/RR-461) Avail: NTIS HC A02/MF A01 CSCL 09/2

In this paper we consider different methods for exchanging data among processors in parallel computers. The most common data exchange operations in parallel numerical methods are examined and different methods for performing them efficiently on each of several ensemble architectures are proposed and analyzed. Our objective is to compare the performance of each particular architecture on each of the data exchange operations. Author (GRA)

N87-11532# Argonne National Lab., Ill.
GUIDE TO SHARING PERSONAL COMPUTER RESOURCES VIA LOCAL AREA NETWORKS
L. Winkler Mar. 1986 69 p
(Contract W-31-109-eng-38)
(DE86-009665; ANL/TM-438) Avail: NTIS HC A04/MF A01

This Guide is for professional staff who commonly need computing tools on personal computers, minicomputers, mainframe computers, and supercomputers. It provides information and recommendations about personal computer local area networks in the context of the larger scheme of computing tools and services at the Laboratory. The material presented here is for the person considering installation of a personal computer local area network. Chapter 1 introduces the reader to the concept of personal computer local area networks and provides background material on networking. Chapter 2 summarizes Computing Services' evaluation of personal computer local area networking in general terms. Chapter 3 describes the technical and functional details of Computing Services' Personal Computer Local Area Network Evaluation and Demonstration Project. Chapters 4 and 5 are for individuals who are familiar with personal computing and who will be responsible for establishing a local area network. Chapter 4 covers technical issues relating to the prototype network installation in Building 221. Chapter 5 warns potential users what to expect when establishing a local area network.DOE

N87-11533# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
A SURVEY OF THE TWENTE UNIVERSITY MULTIPROCESSOR (TUMULT) SYSTEM, A REAL TIME MULTIPROCESSOR SYSTEM
Pierre G. Jansen Nov. 1985 11 p
(INF-85-22; ETN-86-98171) Avail: NTIS HC A02/MF A01

A modular extendible multiprocessor system in PASCAL is described. All memory is distributed and processors communicate in parallel via a fast and reliable local switching network instead of a shared bus. A distributed real time operating system is being designed and implemented, consisting of a multitasking subsystem per processor. Processes can communicate via a message passing mechanism. Communication links and processes are dynamically created and disposed by the application. A distributed exception mechanism is offered to recover from malfunctioning of resources or processes. ESA

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N87-11534*# Martin Marietta Corp., Denver, Colo.
EVALUATION OF AUTOMATED DECISIONMAKING METHODOLOGIES AND DEVELOPMENT OF AN INTEGRATED ROBOTIC SYSTEM SIMULATION, APPENDIX A
D. C. Haley, B. J. Almand, M. M. Thomas, L. D. Krauze, K. D. Gremban, J. C. Sanborn, J. H. Kelly, and T. M. Depkovich Sep. 1984 235 p
(Contract NAS1-16759)
(NASA-CR-172402; NAS 1.26:172402; MCR-84-549-App-A) Avail: NTIS HC A11/MF A01 CSCL 09B

A generic computer simulation for manipulator systems (ROBSIM) was implemented and the specific technologies necessary to increase the role of automation in various missions were developed. The specific items developed were: (1) Capability for definition of a manipulator system consisting of multiple arms, load objects, and an environment; (2) Capability for kinematic analysis, requirements analysis, and response simulation of manipulator motion; (3) Postprocessing options such as graphic replay of simulated motion and manipulator parameter plotting; (4) Investigation and simulation of various control methods including manual force/torque and active compliance control; (5) Evaluation and implementation of three obstacle avoidance methods; (6) Video simulation and edge detection; and (7) Software simulation validation. This appendix is the user's guide and includes examples of program runs and outputs as well as instructions for program use. Author

N87-11535*# Martin Marietta Corp., Denver, Colo.
EVALUATION OF AUTOMATED DECISIONMAKING METHODOLOGIES AND DEVELOPMENT OF AN INTEGRATED ROBOTIC SYSTEM SIMULATION, APPENDIX B
D. C. Haley, B. J. Almand, M. M. Thomas, L. D. Krauze, K. D. Gremban, J. C. Sanborn, J. H. Kelly, and T. M. Depkovich Sep. 1984 197 p
(Contract NAS1-16759)
(NASA-CR-172403; NAS 1.26:172403; MCR-84-549-App-B) Avail: NTIS HC A09/MF A01 CSCL 09B

The purpose of the Robotics Simulation (ROBSIM) program is to provide a broad range of computer capabilities to assist in the design, verification, simulation, and study of robotic systems. ROBSIM is programmed in FORTRAN 77 and implemented on a VAX 11/750 computer using the VMS operating system. This programmer's guide describes the ROBSIM implementation and program logic flow, and the functions and structures of the different subroutines. With this manual and the in-code documentation, and

experienced programmer can incorporate additional routines and modify existing ones to add desired capabilities. Author

N87-11536*# Martin Marietta Aerospace, Denver, Colo.
EVALUATION OF AUTOMATED DECISIONMAKING METHODOLOGIES AND DEVELOPMENT OF AN INTEGRATED ROBOTIC SYSTEM SIMULATION. APPENDIX A: ROBSIM USER'S GUIDE
D. C. Haley, B. J. Almand, M. M. Thomas, L. D. Krauze, K. D. Gremban, J. C. Sanborn, J. H. Kelley, T. M. Depkovich, W. J. Wolfe, and T. Nguyen Mar. 1986 302 p
(Contract NAS1-16759)
(NASA-CR-178051; NAS 1.26:178051; MCR-85-665-App-A) Avail: NTIS HC A14/MF A01 CSCL 09B

The purpose of the Robotics Simulation Program is to provide a broad range of computer capabilities to assist in the design, verification, simulation, and study of robotics systems. ROBSIM is program in FORTRAN 77 for use on a VAX 11/750 computer under the VMS operating system. This user's guide describes the capabilities of the ROBSIM programs, including the system definition function, the analysis tools function and the postprocessor function. The options a user may encounter with each of these executables are explained in detail and the different program prompts appearing to the user are included. Some useful suggestions concerning the appropriate answers to be given by the user are provided. An example user interactive run in enclosed for each of the main program services, and some of the capabilities are illustrated. Author

N87-11537# Los Alamos National Lab., N. Mex.
MACHINE LEARNING USING A HIGHER ORDER CORRELATION NETWORK
Y. C. Lee, G. Doolen, H. H. Chen, G. Z. Sun, T. Maxwell, and H. Y. Lee 1986 41 p Presented at the Evolution, Games and Learning Conference, Los Alamos, N. Mex., 20 May 1986 Prepared in cooperation with Maryland Univ., College Park
(Contract W-7405-eng-36)
(DE86-010183; LA-UR-86-1288; CONF-8605108-1) Avail: NTIS HC A03/MF A01

A high-order correlation tensor formalism for neural networks is described. The model can simulate auto associative, heteroassociative, as well as multiassociative memory. For the autoassociative model, simulation results show a drastic increase in the memory capacity and speed over that of the standard Hopfield-like correlation matrix methods. The possibility of using multiassociative memory for a learning universal inference network is also discussed. DOE

N87-11538# Oak Ridge National Lab., Tenn.
ADVANCES IN CONCURRENT COMPUTERS FOR AUTONOMOUS ROBOTS
J. Barhen, E. C. Halbert, and J. R. Einstein 1986 32 p Presented at the World Conference on Robotics Research, Scottsdale, Ariz., 19 Aug. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008236; CONF-860841-2) Avail: NTIS HC A03/MF A01

Some of the most challenging computational requirements facing scientists and engineers today arise within the framework of intelligent autonomous systems. To enable robots to work effectively in real time in an unstructured environment, one needs to solve repeatedly a variety of highly complex mathematical problems such as on-line planning, vision, sensor fusion, navigation, manipulator dynamics and control. The computational requirements of most of these problems fall into the supercomputer class, but ultimately one needs to process them onboard the autonomous machine. Currently, the only realistic option is VLSI-based concurrent computation. This paper builds on the recent development of a VLSI hypercube supercomputer, to address the fundamental issue of implementing robotic algorithms on actual concurrent hardware. DOE

N87-11539# Politecnico di Milano (Italy). Dipt. di Elettronica.
A MULTIVARIABLE SELF-TUNING CONTROLLER WITH INTEGRAL ACTION
Riccardo Scattolini 1986 30 p Sponsored by Centro di Teoria dei Sistemi, CNR and Max Planck Inst.
(Rept-86-002; ETN-86-97938) Avail: NTIS HC A03/MF A01

A generalized minimum variance self-tuning control algorithm for multivariable systems described by a CARIMA model is presented. It is shown that the resulting control system exhibits effective integrating properties, thus ensuring the robust zero-error regulation for any constant set point and load disturbance. The major limitations of the technique are concerned with the knowledge a-priori required on the system delay structure. Simulations show that the algorithm is well suited to control minimum phase and/or asymptotically stable plants, while dealing with nonminimum phase and unstable systems calls for a careful tuning of the parameters entering the performance index. In order to improve the performance, modifications to the basic algorithm can be given, such as the direct feedforward compensation of measurable load disturbances, and the development of a continuous time equivalent. ESA

N87-11540# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A NOTE ON WAITING TIMES IN SYSTEMS WITH QUEUES IN PARALLEL
J. P. C. Blanc 1985 13 p
(Rept-85-46; ETN-86-98476) Avail: NTIS HC A02/MF A01

Numerical data concerning the mean and variance of the waiting time distribution for systems with queues in parallel, in which customers choose the shortest queue upon arrival are presented. A numerical method for calculating state probabilities and moments of queue length distributions is outlined. The method is based on power series expansions and recursion. It is applicable to systems with more than one waiting line. Numerical data concerning the mean and variance of the waiting time distribution for systems with queues in parallel, in which customers choose the shortest queue upon arrival are presented. A numerical method for calculating state probabilities and moments of queue length distributions is outlined. The method is based on power series expansions and recursion. It is applicable to systems with more than one waiting line. ESA

N87-11541# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
REDUCTION AND RECONSTRUCTION OF CONTROL KNOWLEDGE IN RULE BASED SYSTEMS. PART 1: REDUCTION THEORY
Cees Witteveen 1985 31 p
(Rept-85-50; ETN-86-98480) Avail: NTIS HC A03/MF A01

A model of rule based systems in which control knowledge can be represented explicitly is introduced. The control structure of this Programmed Rule System (PRS) determines the rule to be chosen next depending on the applicability of the current rule and can be viewed as a straightforward generalization of the Markov control structure for production systems. The relation between control structure and the behavior of a PRS is analyzed. Properties of systems whose observable behaviors (traces) are identical, while their control structures might differ are investigated. It is shown that for every PRS M a most efficient PRS M' can be obtained such that M and M' generate the same observable behavior. Such a PRS M' is called a minimal reduction of M. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N87-11542*# Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
NUMERICAL ALGORITHMS FOR FINITE ELEMENT COMPUTATIONS ON CONCURRENT PROCESSORS Semiannual Report, 1 Mar. - 31 Aug. 1986
J. M. Ortega Sep. 1986 5 p

(Grant NAG1-46)
(NASA-CR-179822; NAS 1.26:179822; UVa/528190/AM87/112) Avail: NTIS HC A02/MF A01 CSCL 12A

The work of several graduate students which relate to the NASA grant is briefly summarized. One student has worked on a detailed analysis of the so-called ijk forms of Gaussian elemination and Cholesky factorization on concurrent processors. Another student has worked on the vectorization of the incomplete Cholesky conjugate method on the CYBER 205. Two more students implemented various versions of Gaussian elimination and Cholesky factorization on the FLEX/32. E.R.

N87-11543*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EFFICIENT METHOD FOR SOLVING THE STEADY EULER EQUATIONS
Meng-Sing Liou 1986 18 p Presented at the 4th Joint Fluid Mechanics, Plasma Dynamics and Lasers Conference, Atlanta, Ga., 12-14 May 1986; sponsored by AIAA and ASME Previously announced in IAA as A86-38442
(Grant AF-AFOSR-0327-84)
(NASA-TM-87329; E-3051; NAS 1.15:87239; AIAA-86-1079) Avail: NTIS HC A02/MF A01 CSCL 12A

An efficient numerical procedure for solving a set of nonlinear partial differential equations is given, specifically for the steady Euler equations. Solutions of the equations were obtained by Newton's linearization procedure, commonly used to solve the roots of nonlinear algebraic equations. In application of the same procedure for solving a set of differential equations we give a theorem showing that a quadratic convergence rate can be achieved. While the domain of quadratic convergence depends on the problems studied and is unknown a priori, we show that firstand second-order derivatives of flux vectors determine whether the condition for quadratic convergence is satisfied. The first derivatives enter as an implicit operator for yielding new iterates and the second derivatives indicates smoothness of the flows considered. Consequently flows involving shocks are expected to require larger number of iterations. First-order upwind discretization in conjunction with the Steger-Warming flux-vector splitting is employed on the implicit operator and a diagonal dominant matrix results. However the explicit operator is represented by first- and seond-order upwind differencings, using both Steger-Warming's and van Leer's splittings. We discuss treatment of boundary conditions and solution procedures for solving the resulting block matrix system. With a set of test problems for one- and two-dimensional flows, we show detailed study as to the efficiency, accuracy, and convergence of the present method. Author

N87-11544# Vanderbilt Univ., Nashville, Tenn. Dept. of Mathematics.
TOUGHNESS AND MATCHING EXTENSION IN GRAPHS
M. D. Plummer May 1986 17 p
(Contract N00014-85-K-0488)
(AD-A169177) Avail: NTIS HC A02/MF A01 CSCL 12/1

In the present paper, we wish to treat some relationships between toughness of a graph and the n-extendability of the graph. We will prove two results. The first says essentially that if a graph has sufficiently high toughness (and has an even number of points) then it must be n-extendable. The second result applies to graphs with toughness less than one and presents an upper bound on the value of n for which such a graph can be n-extendable. In the final section, we compare and contrast these results with the n-factor results of Enomoto, Jackson, Katerinis and A. Saito. GRA

N87-11545# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
GRID GENERATION AROUND CAR CONFIGURATIONS ABOVE A FLAT GROUND PLANE USING TRANSFINITE INTERPOLATION
Torsten Berglind Nov. 1985 36 p
(FFA-139; ETN-86-97855) Avail: NTIS HC A03/MF A01

A computational procedure for the generation of grids around car configurations above a flat ground plane in two and three dimensions is presented. The procedure is based on transfinite interpolation in which interior grid points are generated from the boundary grid points by interpolation. The use of an 0-0 type of grid automatically clusters grid points in regions where high resolution is needed. Because of the existence of a ground plane very close to the body, the flow region is divided into several subregions, two in the 2D case and three in the 3D case, making it possible to obtain nearly orthogonal grids. At the grid interfaces between subregions continuity conditions on grid points, grid spacing, and grid-line orientation are imposed. Alternative mapping types are discussed and test examples illustrate the capabilities of the method. ESA

N87-11546# Rome Univ. (Italy). Dipt. di Fisica.
EQUIVALENT CLASSES OF INTEGRABLE NONLINEAR EVOLUTION EQUATIONS AND GENERALIZED MIURA TRANSFORMATIONS
Deng-yuan Chen, D. Levi, and Yi-shen Li 13 Jan. 1986 7 p
(Preprint-497; ETN-86-97929) Avail: NTIS HC A02/MF A01

The recursion operator that defines the class of integrable nonlinear evolution equations (NEE) associated to a spectral problem (SP) for matrices of rank two depending quadratically on the spectral parameter is presented. The existence of four different transformations which transform the given SP into that of Zakhorov and Shabat (ZS) is shown. By composing these transformations, the so called elementary Backlund transformation for the ZS SP is recovered. The complete equivalence of the given class of NEE to the one associated to the ZS SP can be proved, under given restrictions. ESA

N87-11547# Rome Univ. (Italy). Dipt. di Fisica.
MULTIFRACTAL WAVE FUNCTION AT THE LOCALIZATION THRESHOLD
C. Castellani and L. Peliti 3 Feb. 1986 7 p
(Preprint-499; ETN-86-97931) Avail: NTIS HC A02/MF A01

It is shown that the field theoretical description of the localization transition exhibits anomalous scaling for the moments of the probability density at the localization threshold. This property suggests a multifractal structure of the wave function. The corresponding singularity distribution is analyzed. ESA

N87-11548# Rome Univ. (Italy). Dipt. di Fisica.
TRANSITION TO STOCHASTICITY IN HAMILTONIAN SYSTEMS: SOME NUMERICAL RESULTS
Andrea Malagoli, Giovanni Paladin, and Angelo Vulpiani 14 Apr. 1986 23 p Submitted for publication
(Preprint-503; ETN-86-97934) Avail: NTIS HC A02/MF A01

The correlation dimension, the maximal Lyapunov exponent, and an indicator of the deviation from the harmonic situation of a Hamiltonian system with three degrees of freedom are measured. Results indicate the existence of structures with noninteger correlation dimension at least on finite, but long, observational times. The transition from the motion on the KAM tori to an ergodic motion on the constant energy surface seems to happen smoothly as energy increases, and is difficult to explain in terms of perturbative methods. ESA

N87-11549# Universitaet der Bundeswehr, Neubiberg (West Germany). Facultaet fuer Luft- und Raumfahrttechnik.
A METHOD FOR THE FAST ESTIMATION OF THE BEHAVIOR OF STOCHASTIC DYNAMIC SYSTEMS Ph.D. Thesis [EIN VERFAHREN ZUR SCHNELLEN ABSCHAETZUNG DES VERHALTENS STOCHASTISCHER DYNAMISCHER SYSTEME]
Dietmar Fischer Dec. 1985 98 p In GERMAN
(ETN-86-97823) Avail: NTIS HC A05/MF A01

A Markov chain method for the calculation of the density of Ito's stochastic differential equations and for the solution of the Fokker-Planck equation is presented. The Markov chain is constructed using the explicit Euler forward differences. In the multidimensional case the components at equal times are treated as stochastically independent random variables. This approach overcomes the high calculation and storage requirements necessary for the calculation of Markov chains. Two applications are

discussed, the phase locked loop of the first order in the case of a randomly perturbed input signal, and the yawing angle oscillations of a magnetically stabilized satellite in a randomly perturbed Earth magnetic field. ESA

N87-11550# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
A NOTE ON PRIME TERMS
G. F. vanderHoeven Apr. 1985 9 p
(INF-85-5; ETN-86-98161) Avail: NTIS HC A02/MF A01

A method for finding the prime implicants of a Boolean function (propositional formula) is described. The problem of finding the prime term using the solution of Quine-McCluskey can be inefficient in time and space, so the method aims at avoiding unnecessary expansions of the set of possible implicants. It is related to the methods used by Blaauw and Duijvestijn (1985) and by Wilson (1976), though it has a recursive structure which is not present in the other solutions. A correctness proof of the solution is included. ESA

N87-11551# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
A NOTE ON MONOTICITY OF A ROSENBROCK METHOD
W. H. Hundsdorfer Feb. 1986 9 p
(CWI-NM-R8606; B8667663; ETN-86-98510) Avail: NTIS HC A02/MF A01

The dissipative differential equation with stationary solution u sup *, with the difference between any solution U(t) and u sup * nonincreasing with t is considered. Necessary and sufficient conditions in order for a similar monotonicity property to hold for numerical approximations computed from a Rosenbrock method are presented. Results also provide global convergence results for modifications of Newton's method. ESA

N87-11552# Kaiserslautern Univ. (West Germany). Dept. of Mathematics.
DIAGONALLY IMPLICIT RUNGE-KUTTA METHODS FOR PARABOLIC EQUATIONS IN CONSERVATION LAW FORM
Karl Graf Finck vonFinckenstein and Buelent Karasoezen (Middle East Technical Univ., Ankara (Turkey).) Apr. 1986 15 p Sponsored by Kaiserlautern Univ. and Middle East Technical Univ., Ankara, Turkey
(Preprint-980; ETN-86-98272) Avail: NTIS HC A02/MF A01

Numerical performance of diagonally implicit Runge-Kutta (DIRK) methods applied to stiff initial value problems resulting from finite-difference semidiscretization of nonlinear parabolic equations is studied. The quasi linear parabolic initial boundary value problem in one space dimension is discretized with respect to the space variable. The resulting stiff ordinary differential equation system is solved numerically in the time variable by the DIRK method. ESA

N87-11553# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
PAIRWISE-COMPARISON METHODS USING FUZZY NUMBERS ON RATIO SCALES WITH GEOMETRIC PROGRESSION
C. G. E. Boender, J. G. deGraan, and F. A. Lootsma 1985 25 p
(Rept-85-24; ETN-86-98459) Avail: NTIS HC A02/MF A01

An unsolved problem in Van Laarhoven and Pedrycz' (1983) fuzzy pairwise-comparison method to rank and rate a finite number of stimuli is tackled. The decision makers express their preference ratios in fuzzy numbers with triangular membership functions. Using ratio scales with geometric progression to quantify judgmental statements, it is found that the triangles usually exhibit a particular form of symmetry: the parameters satisfy the golden-section rule so that the logarithms of the fuzzy preference ratios have membership functions with isosceles triangles. Under additional conditions (which do not severely limit the practical usefulness of the method) the set of linear equations with fuzzy right-hand sides can be solved. The method only asks the decision makers an estimate of their overall fuzziness, and certain anomalies of the original method can be removed. ESA

N87-11554# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
THE STRUCTURE OF ORBITS IN DYNAMICAL SYSTEMS (REVISED VERSION)
J. M. Aarts 1985 34 p
(Rept-85-28; ETN-86-98460) Avail: NTIS HC A03/MF A01

Spaces which are locally homomorphic to O x IR, topological product of the rationals O and the reals IR, and arcwise connected are studied. It is shown that such spaces are the image of IR under a one-to-one and continuous map having the arc lifting property. A necessary and sufficient condition for a separable and metrizable space X to be the orbit in a flow is presented. A structure theorem is obtained: a space X is the orbit of a Poisson-stable and aperiodic motion if and only if X is homomorphic to the suspension of a universally transitive homomorphism of O. ESA

N87-11555# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
AN ITERATIVE SOLUTION METHOD FOR SOLVING f(A)x=b, USING cg-INFORMATION OBTAINED FOR THE SYMMETRIC POSITIVE DEFINITE MATRIX A
H. A. vanderVorst 1985 23 p
(Rept-85-32; ETN-86-98463) Avail: NTIS HC A02/MF A01

It is shown how intermediate information obtained by the conjugate gradients (cg) algorithm (or by the Lanczos algorithm) can be used to solve f(A)x=b iteratively in an efficient way, for suitable functions f. The case f(A) = Asq is discussed. The problem of solving Ax = b for different right-hand sides b is studied. A variant on an algorithm for that problem which does not seem to suffer from the usual loss of orthogonality in the standard cg and Lanczos algorithms is proposed. ESA

N87-11556# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
A CONVERGENCE PROOF OF A MULTIGRID METHOD
I. A. M. Goddijn 1985 61 p
(Rept-85-39; ETN-86-98469) Avail: NTIS HC A04/MF A01

It is shown that the differet levels of a multigrid method are connected by a recurrence relation between operators. Using this relation the convergence-proof of this method, given by Braess and Hackbusch (1983) is reformulated. It is shown that (with modifications) their convergence-proof is valid for more general problems. The deduced convergence-factor of the multigrid method is uniform in the stepsize h and independent of the number of coarse grid corrections, so it is valid for the V-cycle and the W-cycle. ESA

N87-11557# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
MULTIPLE OBJECTIVE MODELING: EXPERIMENTAL RESULTS WITH INTERACTIVE METHODS IN THE NETHERLANDS
Matthijs Kok 1985 34 p Sponsored by Ministry of Economic Affairs, The Hague, Netherlands
(Rept-85-49; ETN-86-98479) Avail: NTIS HC A03/MF A01

An energy supply model which handles economic, environmental, and strategic factors was developed. Results of the model, using an interactive multiobjective linear programming method and preference information of representatives (actors) of organizations and institutes involved in energy policy problem are presented. Several methods and objective functions were used to obtain insight into the fuzziness of the preferences and to investigate empirically the differences between the interactive methods. The behavior of the actors during the interactive process and their treatment of uncertainties is mentioned. ESA

N87-11558# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON NUMERICAL DISPERSION BY UPWIND DIFFERENCING
Bram vanLeer 1985 15 p
(Rept-85-51; ETN-86-98481) Avail: NTIS HC A02/MF A01

Upwind-biased difference schemes for the linear one-dimensional convection equation are defined. It is demonstrated that the numerical dispersion caused by such schemes changes

sign in the middle of the allowed Courant-Friedrichs-Lewy number range. This makes it possible to annihilate dispersive errors in two steps. ESA

N87-11559# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics.
COMPARISON OF SOME PARTIAL DIFFERENTIAL EQUATION MODELS OF FLEXIBLE STRUCTURES
J. Bontsema, R. F. Curtain, and J. M. Schumacher 1986 26 p Presented at the 4th IFAC Symposium on Control of Distributed Parameter Systems, Pasadena, Calif., 30 Jun. - 3 Jul. 1986 Sponsored by Netherlands Foundation for Technical Sciences
(TW-270; B8664377; ETN-86-98504) Avail: NTIS HC A03/MF A01

Three partial differential equation models for a flexible beam with different types of damping and varying parameter values are compared. Robust controllers can be designed to stabilize all linear systems whose transfer functions lie within a ball in the L infinity norm. Given a nominal model for the flexible beam, which sets of models can be stabilized by the same finite-dimensional robust controller is calculated. ESA

N87-11560# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
LINEAR STABILITY OF THE HOPSCOTCH SCHEME
W. H. Hundsdorfer and J. G. Verwer Jan. 1986 12 p Submitted for publication
(CWI-NM-R8603; B8667668; ETN-86-98507) Avail: NTIS HC A02/MF A01

The hopscotch numerical integration technique for time-dependent partial differential equations is introduced. Its linear stability properties are examined. A general theorem which provides sufficient conditions for boundedness of the numerical solution during time stepping on a fixed space-time mesh is presented. This theorem has applications in parabolic problems. For the one-space dimensional convection-diffusion equation, a detailed stability analysis of the odd-even scheme combined with central and one-sided finite differences, is presented. Stability based on the spectral condition is compared with von Neumann stability. Although the spectral condition gives no guarantee for stability, it does provide useful information. It is a necessay condition for stronger stability inequalities. In cases where such stronger stability inequalities are very hard to analyze (nonconstant coefficients, boundaries) the spectral condition still may be relatively easy to check, giving an idea of permissable step sizes. ESA

N87-11561# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE NUMERICAL INTEGRATION OF SECOND-ORDER INITIAL VALUE PROBLEMS WITH A PERIODIC FORCING FUNCTION
P. J. vanderHouwen, B. P. Sommeijer, K. Strehmel, and R. Weiner Feb. 1986 24 p Submitted for publication
(CWI-NM-R8604; B8667667; ETN-86-98508) Avail: NTIS HC A02/MF A01

Runge-Kutta-Nystrom type methods and predictor-corrector methods for the accurate solution of second-order differential equations of which the solution is dominated by the forced oscillation originating from an external, periodic forcing term are constructed. For a family of second-order explicit and linearly implicit Runge-Kutta-Nystrom methods, it is shown that the forced oscillation is represented with zero phase lag. For a family of predictor-corrector methods of fourth-order, it is shown that the phase lag order and the dissipation order of the forced oscillation can be made arbitrarily high. Numerical examples illustrate the effectiveness of the reduced phase lag methods. ESA

N87-11562# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Methods.
THE ORDER OF B-CONVERGENCE OF ALGEBRAICALLY STABLE RUNGE-KUTTA METHODS
K. Burrage and W. H. Hundsdorfer Feb. 1986 10 p
(CWI-NM-R8607; B8667664; ETN-86-98511) Avail: NTIS HC A02/MF A01

It is shown that for nonlinear dissipative problems, only a small class of Runge-Kutta methods have an order of optimal B-convergence one higher than the stage order. It is proved that such methods have at most classical order three. ESA

N87-11563# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
CONVERGENCE ANALYSIS OF ONE-STEP SCHEMES IN THE METHOD OF LINES
J. M. Sanz-Serna and J. G. Verwer Mar. 1986 15 p Submitted for publication
(CWI-NM-R8608; B8667665; ETN-86-98512) Avail: NTIS HC A02/MF A01

Fundamental results concerning the analysis of one-step schemes for semidiscretizations of evolutionary problems in partial differential equations are exposed. The interplay between the stability and convergence properties of the fully discrete scheme and those of the ordinary differential equations solver is emphasized. Order reduction is treated. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N87-11564# Rome Univ. (Italy). Dipt. di Fisica.
SCALING LAW AND ASYMPTOTIC DISTRIBUTION OF LYAPUNOV EXPONENTS IN CONSERVATIVE DYNAMICAL SYSTEMS WITH MANY DEGREES OF FREEDOM
G. Paladin and A. Vulpiani 22 Jan. 1986 18 p Submitted for publication
(Nota-Interna-859; ETN-86-97893) Avail: NTIS HC A02/MF A01

The infinite product of 2N x 2N conservative random matrices which mimics the chaotic behavior of hamiltonian systems with N+1 degrees of freedom made of weakly nearest neighbor coupled oscillators is studied. The maximum Lyapunov exponent (L1) exhibits a power law behavior as a function of the coupling constant Sigma: L1 = Sigma sup Beta (Beta = 1/2 or 2/3, depending on the probability distribution of the matrix elements). These power laws do not depend on N and when increasing N, L1 quickly tends to an asymptotic value which only depends on Sigma and the kind of probability distribution chosen for building up the matrices. The spectrum of the Lyapunov exponents is calculated, showing that it has a thermodynamic limit of large N. This suggests the existence of a Kolmogorov entropy per degree of freedom proportional to the asymptotic value. ESA

N87-11565# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
MULTIVARIATE CALIBRATION: A GENERALIZATION OF THE CLASSICAL ESTIMATOR
C. A. J. Lieftinck-Koeijers 1985 26 p
(Rept-85-31; ETN-86-98462) Avail: NTIS HC A03/MF A01

A generalization of the classical estimator for multivariate regression problems is considered. It is shown that this estimator has a finite mean if the dimension, say p, of the response variable is greater than 2, and it is shown that the mean squared error is finite for p greater than 4. Exact expressions for the mean and the mean squared error are given in terms of expectations of Poisson variables, which can be easily approximated. ESA

N87-11566# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
ON LOCAL AND NONLOCAL MEASURES OF EFFICIENCY
Wilbert C. M. Kallenberg and Teresa Ledwina May 1986 31 p
(ISSN-0169-2690; ETN-86-98514) Avail: NTIS HC A03/MF A01

Results on the limiting equivalence of local and nonlocal measures of efficiency are obtained. It is clarified why the equivalence occurs in so many testing and estimation problems. Uniformity of the convergence is a key-point. The concepts of Frechet-type and Hadamard-type differentiability, which imply

uniformity, play an important role. The theory is applied to tests based on linear rank statistics showing equivalence of the local limit of exact Bahadur efficiency and Pitman efficiency. The relation between the inaccuracy rate and the asymptotic variance of L-estimators is investigated. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N87-11567*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A METHODOLOGY FOR DESIGNING ROBUST MULTIVARIABLE NONLINEAR CONTROL SYSTEMS Ph.D. Thesis
Daniel Backer Grunberg Sep. 1986 233 p
(Grant NAG2-297)
(NASA-CR-179891; NAS 1.26:179891; LIDS-TH-1609) Avail: NTIS HC A11/MF A01 CSCL 12B

A new methodology is described for the design of nonlinear dynamic controllers for nonlinear multivariable systems providing guarantees of closed-loop stability, performance, and robustness. The methodology is an extension of the Linear-Quadratic-Gaussian with Loop-Transfer-Recovery (LQG/LTR) methodology for linear systems, thus hinging upon the idea of constructing an approximate inverse operator for the plant. A major feature of the methodology is a unification of both the state-space and input-output formulations. In addition, new results on stability theory, nonlinear state estimation, and optimal nonlinear regulator theory are presented, including the guaranteed global properties of the extended Kalman filter and optimal nonlinear regulators. Author

N87-11568# General Technology Systems B.V., The Hague (Netherlands).
ECONOMIC STUDY FOR NAVSAT Final Report
G. A. deBoer, M. vanderMatten, R. deBos, M. G. Pearson, S. Ratcliffe, and H. H. Schuringa Paris ESA 30 Oct. 1985 212 p
(Contract ESA-6022/84-F-RD(SC))
(GTS-84051; ESA-CR(P)-2241; ETN-86-98119) Avail: NTIS HC A10/MF A01

The performance and cost of terrestrial radio navigation systems, and the potential benefits and savings of satellite navigation for airlines, shipping, survey, land vehicles, and low orbiting satellites are analyzed. The yearly worldwide cost of radio navigation to airlines is $ 140 M/year (excluding user charges) and to shipping $280 M/year. The yearly cost of the ground system is estimated at $720 M/year. Although the transition to a system like NAVSAT will be lengthy, the benefits will be significant. The potential saving of fuel alone for airlines on the North Atlantic route could amount to $100 M/year (3%) and for shipping $200 M/year worldwide (1%) when mature systems are approved and in general operation. ESA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N87-11569# Stanford Univ., Calif. Systems Optimization Lab.
AN ALGORITHM FOR RESCALING A MATRIX POSITIVE DEFINITE
Hui Hu Apr. 1986 26 p
(Contracts N00014-85-K-0343; DE-AA03-76SF00326; DE-AS03-76ER-72018; Grants NSF DMS-84-20623; NSF ECS-83-12142)
(AD-A169257; SU-SOL-86-10) Avail: NTIS HC A03/MF A01 CSCL 12/1

For a given square real matrix M, we present a general algorithm which decides the existence of a positive diagonal matrix D such that DM is positive definite and which constructs the D if it exists. It is shown that solving this matrix rescaling problem is equivalent to finding a solution of an infinite system of linear inequalities. The algorithm solves the infinite system of linear inequalities by generating and solving a sequence of linear programs. GRA

N87-11570# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
A FAMILY OF FIBONACCI-LIKE SEQUENCES
Peter R. J. Asveld Jun. 1985 7 p
(INF-85-10; ETN-86-98163) Avail: NTIS HC A02/MF A01

The recurrence relation Gn = Gn-1 + Gn-2 + Sigma k, j=0 alpha j n sup j with G0 = G1 = 1 is considered. The term Gn is expressed in terms of Fibonacci numbers Fn and Fn-1, and in the parameters alpha 0,..., alpha k. ESA

N87-11571# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
ON RESTRICTIONS OF PROJECTIONS ALONG SEPARABLE METRIC SPACES
Zdenek Frolik 1985 15 p
(Rept-85-42; ETN-86-98472) Avail: NTIS HC A02/MF A01

S-maps and S'-maps are introduced. The connection to continuous mapping from metric spaces preserving isolatedly sigma-decomposable families is shown. A mapping f: X to Y is an S-map if there exists an embedding h of X into Y x S, where S is a separable metrizable space, such that f is h followed by the projection Y x S to Y. A mapping f: X to Y is an S'-map if f is continuous, and there exists a separable metrizable space S, and a subset Z is a subset of X x S which projects onto X, such that the product map f x 1S restricted to Z is an embedding. Both S and S' maps form a category. The two concepts apply directly to the theory of absolute Suslin sets in the class of metrizable spaces. ESA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N87-11572# California Univ., Berkeley.
INAUGURAL CONFERENCE OF THE BERKELEY RESEARCH GROUP IN NONLINEAR SYSTEMS AND DYNAMICS Final Report, 7 Jan. 1985 - 6 Jan. 1986
S. S. Sastry May 1986 12 p Proceedings of conference
(Contract DAAG29-85-M-0166)
(AD-A169175; ARO-22553.1-MA-CF) Avail: NTIS HC A02/MF A01 CSCL 06/4

Abstracts are presented for the following papers: Nonlinear Problems in Robotics; The Patterns on Molluscan Shells; Turbulence and Low Dimensional Chaos; A Geometric and Asymptotic Approach; Experiments on Nonlinear Dynamics in Solid State Systems; Spectral University in Macromolecular Sensitivity; and Global Dynamical Properties. GRA

N87-11573# Los Alamos National Lab., N. Mex.
FIBER OPTIC, FARADAY ROTATION CURRENT SENSOR
L. R. Veeser and G. W. Day (National Bureau of Standards, Boulder, Colo.) 1986 9 p Presented at the 4th International Conference on Megagauss Magnetic-Field Generation and Related Topics, Santa Fe, N. Mex., 24 Jul. 1986 Prepared in cooperation with National Bureau of Standards, Boulder, Colo.
(Contract W-7405-eng-36)
(DE86-012413; LA-UR-86-2084; CONF-860703-2) Avail: NTIS HC A02/MF A01

The Second Megagauss Conference in 1979 reported experiments using the Faraday magneto-optic effect in a glass rod to measure large electric current pulses or magnetic fields. Since then we have seen the development of single-mode optical fibers carrying polarized light in a closed loop around a current load. A fiber optic Faraday rotation sensor will integrate the flux, instead

of sampling it at a discrete point, to get a measurement independent of the current distribution. Early Faraday rotation experiments using optical fibers to measure currents dealt with problems such as fiber birefringence and difficulties in launching light into the tiny fiber cores. We have built on those experiments, working to reduce the effects of shocks and obtaining higher bandwidths, absolute calibration, and computerized recording and data analysis, to develop the Faraday rotation sensors into a routine current diagnostic. For large current pulses we find reduced sensitivity to electromagnetic interference and other backgrounds than for Rogowski loops; often the fiber optic sensors are useful where conductive probes cannot be used at all. The fiber optic sensors and some practical matters involved in fielding them are described. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N87-11574 Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik.

DETERMINATION OF THE MASS CONCENTRATION OF THE PARTICLES IN AEROSOLS USING THE SOUND VELOCITY MEASUREMENT Final Report [BESTIMMUNG DES MASSENANTEILS DER PARTIKEL IN AEROSOLEN UEBER DIE MESSUNG DER SCHALLGESCHWINDIGKEIT]

1986 35 p In GERMAN

(FR-235/20-1; ETN-86-97828) Copyright. Avail: Issuing Activity

The method to measure large mass concentration in a gas-particle mixture was developed. The theoretical fundamentals, based on the equations of motion of a multiphase system, are explained. Weak pressure waves propagating through the mixture were used to determine the mass concentration. Two pressure gages measure the propagation velocity and the pressure variation accompanying these waves. The mass concentration can be determined from the Ranking-Hugoniot relations. The results demonstrate the feasibility of the method. ESA

N87-11575*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.

SOUND PROPAGATION OVER UNEVEN GROUND AND IRREGULAR TOPOGRAPHY Semiannual Status Report, Feb. - Aug. 1986

James A. Kearns, Allan D. Pierce, and Geoffrey L. Main Oct. 1986 23 p

(Grant NAG1-566)

(NASA-CR-179827; NAS 1.26:179827; SASR-3) Avail: NTIS HC A02/MF A01 CSCL 20A

Theoretical, computational, and experimental techniques for predicting the effects of irregular topography on long range sound propagation in the atmosphere was developed. Irregular topography here is understood to imply a ground surface that is not idealized as being perfectly flat or that is not idealized as having a constant specific acoustic impedance. The interest focuses on circumstances where the propagation is similar to what might be expected for noise from low altitude air vehicles flying over suburban or rural terrain, such that rays from the source arrive at angles close to grazing incidence. Author

N87-11576*# Pope (L. D.), Woodlands, Tex.

PROPELLER AIRCRAFT INTERIOR NOISE MODEL UTILIZATION STUDY AND VALIDATION

L. D. Pope Sep. 1984 248 p

(Contract NAS1-17281)

(NASA-CR-172428; NAS 1.26:172428; Rept-84-001) Avail: NTIS HC A11/MF A01 CSCL 20A

Utilization and validation of a computer program designed for aircraft interior noise prediction is considered. The program, entitled PAIN (an acronym for Propeller Aircraft Interior Noise), permits (in theory) predictions of sound levels inside propeller driven aircraft arising from sidewall transmission. The objective of the work reported was to determine the practicality of making predictions for various airplanes and the extent of the program's capabilities. The ultimate purpose was to discern the quality of predictions for tonal levels inside an aircraft occurring at the propeller blade passage frequency and its harmonics. The effort involved three tasks: (1) program validation through comparisons of predictions with scale-model test results; (2) development of utilization schemes for large (full scale) fuselages; and (3) validation through comparisons of predictions with measurements taken in flight tests on a turboprop aircraft. Findings should enable future users of the program to efficiently undertake and correctly interpret predictions. Author

N87-11577*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

AN EXPERIMENTAL INVESTIGATION OF THE INTERIOR NOISE CONTROL EFFECTS OF PROPELLER SYNCHROPHASING

J. D. Jones and C. R. Fuller Oct. 1986 103 p

(Grant NAG1-390)

(NASA-CR-178185; NAS 1.26:178185) Avail: NTIS HC A06/MF A01 CSCL 20A

A simplified cylindrical model of an aircraft fuselage is used to investigate the mechanisms of interior noise suppression using synchrophasing techniques. This investigation allows isolation of important parameters to define the characteristics of synchrophasing. The optimum synchrophase angle for maximum noise reduction is found for several interior microphone positions with pure tone source excitation. Noise reductions of up to 30 dB are shown for some microphone positions, however, overall reductions are less. A computer algorithm is developed to decompose the cylinder vibration into modal components over a wide range of synchrophase angles. The circumferential modal response of the shell vibration is shown to govern the transmission of sound into the cylinder rather than localized transmission. As well as investigating synchrophasing, the interior sound field due to sources typical of propellers has been measured and discussed. Author

N87-11578# Rolls-Royce Ltd., Derby (England).

AIRCRAFT NOISE MEASUREMENT: THE 1.2 METRE MICROPHONE HEIGHT SAGA

M. J. T. Smith 18 Feb. 1986 7 p Presented at Internoise 86, Boston, Mass., Jul. 1986

(PNR-90315; ETN-86-98020) Avail: NTIS HC A02/MF A01

The spectral differences in noise measurements on a range of aircraft types, when using microphones placed in a variety of locations between ground level and 10m were studied. Results show that an inverted microphone configuration, on an easily portable plate, can be specified to eliminate the severe ground interference effects experienced with the International Standard 1.2m high microphone. The move towards such a system by ICAO, for propeller powered light aircraft noise certification, is approved. A move away from the 1.2m system used in the certification of other types of aircraft should be encouraged. Further work should be conducted to confirm the ideal microphone-to-plate separation for jet powered aircraft, and to examine whether the otherwise minimal deviations from pressure-doubling can be further reduced. ESA

N87-11579 Stanford Univ., Calif.

SEPARATION OF AIRBORNE AND STRUCTUREBORNE NOISE RADIATED BY PLATES CONSTRUCTED OF CONVENTIONAL AND COMPOSITE MATERIALS WITH APPLICATIONS FOR PREDICTION OF INTERIOR NOISE PATHS IN PROPELLER DRIVEN AIRCRAFT Ph.D. Thesis

Michael C. McGary 1986 315 p

Avail: Univ. Microfilms Order No. DA8612765

The anticipated application of advanced turboprop propulsion systems and the use of composite materials in primary structure is expected to increase the interior noise of future aircraft to unacceptably high levels. The absence of technically and economically feasible noise source-path diagnostics tools has been a prime obstacle in the development of efficient noise control treatments

for propeller driven aircraft. A new diagnostic method which permits the separation and prediction of the fully coherent airborne and structureborne components of the sound radiated by plates or thin shells has been developed. Analytical and experimental studies of the proposed method were performed on plates constructed of both conventional and composite materials. The results of the study indicate that the proposed method can be applied to a variety of aircraft materials, could be used in flight, and has fewer encumbrances than the other diagnostic tools currently available. The study has also revealed that the noise radiation of vibrating plates in low frequency regime due to combined airborne and structureborne inputs possesses a strong synergistic nature. The large influence of the interaction between the airborne and structureborne terms has been hitherto ignored by researchers of aircraft interior noise problems. noise problems. Dissert. Abstr.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N87-11580 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
MEASUREMENTS PERFORMED AT THE NATIONAL PHYSICAL LABORATORY FOR AN INTERNATIONAL INTERCOMPARISON OF NEUTRON FLUENCE RATE MEASUREMENTS FOR MONO-ENERGETIC FAST NEUTRONS USING THE 115 SUB In(n, GAMMA) REACTION
J. B. Hunt May 1986 76 p
(NPL-RS(EXT)-81; ETN-86-97991) Copyright. Avail: Issuing Activity

Neutron energies of 144 and 565 keV were measured using transfer devices consisting of matched pairs of indium foils activated via the in-115(n, gamma) In-116m reaction. The relative 54 min In-116m activity was determined with a 4 pi Beta gas flow proportional counter. The neutron fluence received by the indium foil was determined using a calibrated standard long counter. The saturated specific Beta-activity of In-116m per unit neutron fluence rate, at both neutron energies, is reported. Corrections for neutron scattering from the surroundings were easily made, corrections for neutron scattering within the target assembly were difficult to evaluate, particularly at 144 keV. This effect dominates the uncertainties associated with the transfer device at this energy. ESA

N87-11581# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Aerosolphysik und Filtertechnik.
NUCLEATION IN BINARY SUPERSATURATED GAS MIXTURES Thesis - Karlsruhe University, West Germany
Helmut Bunz Feb. 1986 97 p In GERMAN; ENGLISH summary
(KfK-4036; ISSN-0303-4003; ETN-86-97835) Avail: NTIS HC A05/MF A01

Cluster formation in supersaturated gases is discussed. The nucleation in a binary gas mixture was researched using the molecular-dynamics method. The main parameters varied were the ratio of the vapor pressures or the depth of the interaction potentials of the two gases, respectively. A Lennard-Jones (6-12)-potential was used as interaction potential. The calculations show that the cluster formation is influenced only little by the more volatile gas as long as the ratio of the vapor pressure is large. Mixed clusters form only if the ratio of the vapor pressures is drastically reduced. In these cases the intermolecular structures of the different binding types are nearly independent of each other so that the total binding energy of the mixed cluster may be expressed by a simple scaling law based on the binding energies of the pure components. ESA

N87-11582# Rome Univ. (Italy). Dipt. di Fisica.
PHYSICS AND EVENT SIMULATION AT HERA WITH H1 (REPORT OF THE WORKING GROUP OF THE H1 COLLABORATION FOR HERA)
J. Field, D. Haidt, G. Grindhammer, G. dAgostini, and B. Stella 2 Oct. 1985 156 p
(Nota-Interna-854; H1-06/85-23; ETN-86-97888) Avail: NTIS HC A08/MF A01

The design of the HERA facility to study exotics (including fragmentation of partons); photon-gluon fusion and heavy quark production; specific models for compositeness; gamma gamma and low Qsq physics; and the electrons to pions ratio and the leptonic multiplicity of the events were discussed. How the different processes were treated in order to generate files of events; studies of the general features of interesting processes to look for signatures and examine the requested performances of the detector; the existence of substructures (excited electrons and leptoquarks analyzed as processes where compositeness could show up) and photoproduction were treated. ESA

N87-11583# Rome Univ. (Italy). Dipt. di Fisica.
THE EXTERNAL MUON DETECTOR FOR ICARUS
M. Conversi, M. Ferro-Luzzi, F. Massa, E. Pagiola, and J. M. Perreau 21 Feb. 1986 19 p
(Nota-Interna-863; ETN-86-97896) Avail: NTIS HC A02/MF A01

It is argued that physics goals, including unambiguous detection of heavy monopoles below the Parker limit, can be achieved by equipping ICARUS with an appropriate External Muon Detector (EMD). The characteristics of the EMD constituent elements (Resistive Plate Counters, RPC) are reported for the existing RPC version. The structure, use and requirements of the EMD are discussed and cost estimates are given. ESA

N87-11584# Rome Univ. (Italy). Dipt. di Fisica.
THE DISCOVERY OF THE POSITRON
Michelangelo deMaria and Arturo Russo 14 Jun. 1985 84 p Submitted for publication Sponsored by Ministero della Pubblica Istruzione, CNR, and National Museum of American History Smithsonian Fellowship
(Preprint-469; ETN-86-97904) Avail: NTIS HC A05/MF A01

The contribution of Dirac, Anderson, Blackett, and Occhialini to the discovery of the positron are discussed. It is argued that the positron was suggested by Dirac, discovered by Anderson, and confirmed by Blackett and Occhialini. ESA

N87-11585# Rome Univ. (Italy). Dipt. di Fisica.
LIGHT GLUINOS AT THE CERN PPBAR COLLECTOR
G. Altarelli, B. Mele, and S. Petrarca 16 Jul. 1985 15 p Sponsored by Ministero della Pubblica Istruzione
(Preprint-470; ETN-86-97905) Avail: NTIS HC A02/MF A01

The exclusion of light gluinos (with decays gluinos yield quark antiquark photino) in ppbar collisions is discussed. It is found that light gluinos are compatible with existing data, the excluded interval of masses being 15GeV less than or = m sub g less than or = 40GeV. ESA

N87-11586# Rome Univ. (Italy). Dipt. di Fisica.
ELECTROWEAK INTERACTIONS
Luciano Maiani Nov. 1985 38 p Presented at EPS International Europhysics Conference on High Energy Physics, Bari, Italy, 18-24 Jul. 1985
(Preprint-482; CERN-Preprint-TH.4326/85; ETN-86-97917) Avail: NTIS HC A03/MF A01

Data from neutrino, e(+)e(-), and W/Z physics is reviewed. Agreement with theory is excellent. The prospects for more precise tests, at the level of the higher order corrections, are illustrated, particularly the possibility of obtaining the Higgs boson mass, from the size of the virtual corrections. Direct searches for the Higgs boson with high energy machines are considered. Nonleptonic weak processes, and attempts to compute delta S=1,2 amplitudes in lattice QCD are treated. Family unification within orthogonal groups, and the existence of mirror fermions are assessed. Theoretical considerations following the observation of a surprisingly large flux of underground muons from Cygnus X-3 are reported. ESA

N87-11587# Rome Univ. (Italy). Dipt. di Fisica.
MOLECULAR DYNAMICS SIMULATION OF RIGID MOLECULES
G. Ciccotti and J. P. Ryckaert 8 Jan. 1986 84 p Sponsored by Belgium FNRS, and CNR
(Grant NATO-1865)
(Preprint-494; ETN-86-97927) Avail: NTIS HC A05/MF A01

The method of constraints is reviewed. The method was devised to carry out molecular dynamics (MD) simulations of complex molecular systems with internal degrees of freedom frozen, in terms of atomic cartesian coordinates. The method was generalized to treat all kinds of holonomic constraints and was adapted to dynamical simulations in ensembles different from the microcanonical one. The statistical-mechanical formalism for these systems, and the equations of motions are derived. The MD algorithms are discussed, and details on the FORTRAN code are presented. ESA

N87-11588# Rome Univ. (Italy). Dipt. di Fisica.
HYPERPHOTONS AND K MESON DECAYS
M. Lusignoli and A. Pugliese 31 Jan. 1986 11 p Revised
(Preprint-498; ETN-86-97930) Avail: NTIS HC A02/MF A01

The branching ratio for the decay K(+) yields pi(+) + the quantum of a massive vector field coupled to the hypercharge current is calculated. The existence of such a particle was suggested to explain the results of the Eotvos (1922) experiment and of K(0)-Kbar(0) regeneration experiments at high energy. The present experimental upper bound is lower than the theoretical expectation by more than three orders of magnitude. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N87-11589*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF BACKING PLATES ON THE ELECTRON EXPOSURE OF THIN POLYMER FILMS
C. Ken Chang (Christopher Newport Coll., Newport News, Va.), Steven M. Seltzer (National Bureau of Standards, Washington, D.C.), and John W. Wilson Nov. 1986 16 p
(Grant NsG-1614)
(NASA-TM-88995; L-16183; NAS 1.15:88995) Avail: NTIS HC A02/MF A01 CSCL 11B

The effects of backing plates on the radiation dose received by thin nylon films were calculated using recently developed multilayer electron transport codes. The film dose increased with increasing atomic number of the backing plate. The estimated dose could be off by a factor of 2 or more if the backing plate were ignored in the calculations. Author

N87-11590# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
SIMULATION OF THE PRELIMINARY GENERAL ELECTRIC SP-100 SPACE REACTOR CONCEPT USING THE ATHENA COMPUTER CODE
C. D. Fletcher 1986 33 p Presented at the 3d Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex. 13 Jan. 1986
(Contract DE-AC07-76ID-01570)
(DE86-005324; EGG-M-28185; CONF-860102-5) Avail: NTIS HC A03/MF A01

The capability to perform thermal-hydraulic analyses of a space reactor using the ATHENA computer code is demonstrated. The fast reactor, liquid-lithium coolant loops, and lithium-filled heat pipes of the preliminary General electric SP-100 design were modeled with ATHENA. Two demonstration transient calculations were performed simulating accident conditions. Calculated results are available for display using the Nuclear Plant Analyzer color graphics analysis tool in addition to traditional plots. ATHENA-calculated results appear reasonable, both for steady state full power conditions, and for the two transients. This analysis represents the first known transient thermal-hydraulic simulation using an integral space reactor system model incorporating heat pipes. DOE

N87-11591# Hanford Engineering Development Lab., Richland, Wash.
SP-100 GROUND ENGINEERING SYSTEM AT HANFORD, VOLUME 2
1986 253 p
(Contract DE-AC06-76FF-02170)
(DE86-009961; HEDL-7538-Vol-2) Avail: NTIS HC A12/MF A01

The SP-100 reactor is intended to provide a reliable power source for space applications. The reactor development program includes a ground test of the reactor systems to demonstrate that reliability and safety issues have been resolved. The use of an existing containment structure provides a unique facility with large safety margins and ample space. Preliminary seismic analysis shows that current site earthquake criteria can be met. The building is currently utilized to house engineering personnel, and the containment area is in use as an assembly facility. Only minimal activity is required to activate major support systems. All of the principal support facilities are in close proximity to the proposed test site. The various systems and facilities and their status are identified. DOE

74 OPTICS

Includes light phenomena; and optical devices.

For lasers see *36 Lasers and Masers.*

N87-11592 National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
CONCAVE DIFFRACTION GRATINGS
M. C. Hutley Oct. 1985 28 p
(NPL-MOM-77; ISSN-0143-7313; ETN-86-97989) Copyright. Avail: Issuing Activity

The need for concave diffraction gratings in ultraviolet, visible, and near infrared spectroscopy is summarized. The relative merits of ruled gratings and those generated using interference or holographic techniques are reviewed. The reduction of aberrations through a suitable choice of recording parameters is discussed, and a grating design which combines the advantages of aberration correction, constant blazed groove profile, and a constant focal distance is described. It is suggested that this grating might form the basis of a simple scanning monochromator performance measurements are described. ESA

N87-11593# Department of the Air Force, Washington, D.C.
OPTICAL FLIP-FLOP SYSTEM Patent
Jack L. Jewell, inventor (to Air Force) Issued 4 Mar. 1986 8 p Supersedes AD-D011165
(AD-D012259; US-Patent-4,573,767; US-Patent-Appl-SN-615612; US-Patent-Class-350-354) Avail: US Patent and Trademark Office CSCL 20/6

An optical flip-flop system has a pair of optically aligned nonlinear Fabry-Perot etalons, one of which acts as a bistable optical device, the other acts as a negative optical gate. The negative optical gate is initially tuned for high transmission and will remain transmissive until impinged upon by a first optical pulse, at which time it will momentarily become nontransmissive. If this nontransmissive state is longer than the recovery time of the bistable optical device, then the bistable optical device will remain nontransmissive until impinged upon by a second optical pulse. Thereupon, the bistable optical device will be transmissive until such time as the negative optical gate becomes nontransmissive again. In this manner the flip-flop system can be readily controlled

by the application of the pair of optical pulses thereto.
Author (GRA)

N87-11594# Department of the Navy, Washington, D. C.
POLYNOMIAL GRATING Patent
John F. Meekins and Herbert Gursky, inventors (to Navy) Issued 25 Mar. 1986 8 p Supersedes AD-D011090
(AD-D012313; US-Patent-4,578,804; US-Patent-Appl-SN-615504; US-Patent-Class-378-84) Avail: US Patent and Trademark Office CSCL 20/6

This patent discloses an apparatus for decomposing far ultraviolet and soft X-ray radiation into its component wavelengths comprising a diffraction grating having a diffraction grating surface defined by a polynomial Z = sum over Q sub K X superscript K and an optimum line spacing. GRA

N87-11595# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.
REAL-TIME PATTERN RECOGNITION USING A MODIFIED LIQUID CRYSTAL TELEVISION IN A COHERENT OPTICAL CORRELATOR
Don A. Gregory and Tracy D. Hudson 15 Nov. 1985 23 p
(AD-A168042; AD-E950834; AMSMI/RD-RE-86-1-TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

A commercially available flat screen Liquid Crystal Television (LCTV) has been slightly modified and used as a spatial light modulator in a Vander Lugt type coherent optical correlator. The small, (54 mm x 40.5 mm) inexpensive, (approx.= $100) LCTV was used as a replacement for extremely expensive modulators normally used in optical data processing such as the Hughes Liquid Crystal Light Valve and the Litton Magneto-Optic Device. Results show that the resolution, contrast, and speed of the LCTV in its present form, are sufficient for some basic real-time pattern recognition applications. Author (GRA)

N87-11596# California Inst. of Tech., Pasadena.
OPTICAL FILTERING TECHNIQUES Final Technical Report, Jan. - Jun. 1985
Demetri Psaltis Mar. 1986 53 p
(Contract F30602-81-C-0206)
(AD-A168084; RADC-TR-86-2) Avail: NTIS HC A04/MF A01 CSCL 09/3

The purpose of this study was to examine the potential of using optical information processing technology for adaptive antenna beamforming and null steering. The adaptive beamforming-/null steering problem consists of estimation of the covariance matrix of the noise field and inversion of the covariance matrix to obtain the antenna element weights which optimize the antennas of the covariance matrix to obtain the antenna element weights which optimize the antenna's directional characteristics (gain pattern). This report examines the adaptive beamforming/nulling problem in view of the capabilities of optics and identifies areas where optics can be used to benefit. GRA

N87-11597# Rome Air Development Center, Griffiss AFB, N.Y.
COMPARISON OF MODAL TO NODAL APPROACHES FOR WAVEFRONT CORRECTION
Donald W. Hanson and Sam E. Fragapane, Jr. Feb. 1986 31 p
(AD-A168088; RADC-TR-85-226) Avail: NTIS HC A03/MF A01 CSCL 20/6

The turbulent atmosphere aberrates optical wavefronts as they propagate through it. These aberrations are responsible for limiting the performance of large aperture ground based optical systems. The issue of whether to implement nodal or modal influence functions to perform wavefront correction in an adaptive optical system is studied. Theoretically, modal wavefront correction is simpler to implement than nodal wavefront correction. This is true for very low mode aberrations, (e.g., tilt, focus). However, for large aperture, visible wavelength, adaptive optical imaging systems the number of modes which are required to be corrected becomes very high. Consequently, for these systems, nodal wavefront correction is more easily implemented. GRA

N87-11598# Argonne National Lab., Ill.
STABILITY OF MULTILAYERS FOR SHORT-WAVELENGTH OPTICS
E. Ziegler, Y. Lepetre, I. K. Schuller, P. J. Viccaro, and E. Spiller (IBM Watson Research Center, Yorktown Heights, N.Y.) Mar. 1986 8 p Presented at the Topical Meeting on Short Wavelength Coherent Radiation, Monterey, Calif., 24 Mar. 1986
(Contract W-31-109-eng-38)
(DE86-012129; CONF-860316-9) Avail: NTIS HC A02/MF A01

A variety of multilayer mirrors with transition metal absorber layers (W-C, Wre-C, Co-C, and Cr-C) have been fabricated and tested up to 1000 C using standard 0-20 X-ray diffraction, Debye-Scherrer scattering and microcleavage transmission electron microscopy. The 0-20 X-ray diffraction during annealing shows the Bragg peak position to shift toward lower angles with increasing temperature. This irreversible shift starts at around 300 C and is equivalent to as much as 12% expansion of the multilayer period with a temperature change from ambient to 750 C. In all cases a crystallization occurs in the metal component between 650-750 C. The different types of crystalline compounds formed have been identified by the Debye-Scherrer technique. As a consequence of this crystallization abrupt changes occur in the multilayer structure. Electron microscopy shows that the surface roughness increases by formation of hillocks and the layered structure is destroyed. Moreover the X-ray reflectivity decreases considerably. The expansion and crystallization are of great importance in cases where a precise multilayer period is required or in devices intended for high X-ray flux applications. DOE

N87-11599# Rome Univ. (Italy). Dipt. di Fisica.
LANGEVIN EQUATIONS WITH NEGATIVE DIFFUSION COEFFICIENTS. A NEW APPROACH TO QUANTUM OPTICS
Horace P. Yuen and Paolo Tombesi 13 Feb. 1986 13 p Sponsored in part by Navy and by NATO
(Nota-Interna-862; ETN-86-97895) Avail: NTIS HC A02/MF A01

Stochastic differential equations with negative diffusion coefficients for applications to the analysis of open quantum systems and nonlinear optical systems are introduced. It is shown how they can be consistently employed for moment calculations. The problem of squeezing is illustrated. ESA

N87-11600# British Aerospace Public Ltd. Co., Bristol (England). Optics Research Dept.
PASSIVE STEREOSCOPIC RANGEFINDER
O. Burgess Sep. 1981 25 p
(BAe-BT-12300; LR48041; ETN-86-97954) Avail: NTIS HC A02/MF A01

A stereoscopic rangefinder where the apparent displacement of the images is measured automatically using linear photodetector arrays is described. The high accuracy of this method of measurement permits the design of an instrument with a relatively short separation between the two optical systems, i.e., it can cope with smaller angles of parallax. The problem of movement between the two optical systems, due to bending of the instrument, causing a false image displacement is addressed via the use of a single objective lens used by both optical systems, an instrument based on the use of Young's slits for measuring any movement between the systems. It should be possible to build an instrument of 0.5 m separation between the optical systems giving an accuracy of 100 m at 5km (2%). ESA

N87-11601# British Aerospace Public Ltd. Co., Bristol (England). Optics Research Dept.
APPLICATION OF THE SPOKE FILTER TO DIGITAL IR IMAGES
N. C. Roberts Dec. 1982 18 p
(BAe-BT-13988; ETN-86-97961) Avail: NTIS HC A02/MF A01

A technique that uses a spoke filter to isolate the convex regions in IR images is described. This information can then be used to identify likely target positions. A small number of IR images was processed using this spoke filter and the results indicate that the technique merits further investigation. ESA

N87-11602# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
AN INFRARED SEARCHLIGHT
Ulf Bjoerkman Jun. 1986 71 p In SWEDISH; ENGLISH summary
(FOA-C-30421-E4; ISSN-0347-3708; ETN-86-98333) Avail: NTIS HC A04/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR 50

An infrared searchlight with semiconductor diodes for scanning in the darkness giving 0.3 W high optical effect in a narrow lobe of + or - 2.5 degrees arc is described. Studies show that diodes to be used are: for less than 10 m up to 15 m, emitting diodes with matrix in an ordinary epoxy capsule; from 50 to 100 m, as above but with a Fresnel lens as collecting lens for the matrix; for less than a few km, laser diodes or optical fibers. The components of the electric circuits are analyzed. ESA

N87-11049*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
PHYSICAL OPTICS ANALYSIS OF A 4-REFLECTOR ANTENNA, PART 2
A. G. Cha *In its* The Telecommunications and Data Acquisition Report (date] p 231 - 243 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 20F

N87-11454 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
NEWS ABOUT THE VISIBILITY OF SIGNAL LIGHTS UNDER THE INFLUENCE OF THE ATMOSPHERE [NEUES ZUR SICHTBARKEIT VON SIGNALLICHT UNTER DEM EINFLUSS DER ATMOSPHAERE]
G. H. Ruppersberg *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 206-207 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N87-11603 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ACTIVE PLASMA EXPERIMENTS
Gerhard Haerendel Jan. 1986 42 p
(MPE-Preprint-43; ASP-49; ISSN-0178-0719; ETN-86-98262) Avail: Issuing Activity

The use of barium plasma clouds for spaceborne experiments and ground-based observation is described. Luminous plasma clouds are generated from releases of barium metal vapor in near-Earth space and subsequently ionized by solar UV radiation. The clouds interact with the magnetic and electric fields, constitute visible tracers of plasma transport, develop odd shapes, and fine structure and can be used for a variety of experiments simulating cosmic processes. ESA

N87-11604 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ADIABATIC COOLING OF THE ARTIFICIAL PORCUPINE PLASMA JET
Yu. Ya. Ruzhin, A. M. Moskalenko, R. A. Treumann, and O. H. Bauer Feb. 1986 26 p Sponsored in part by Deutschen Forschungsgemeinschaft
(Contracts BMFT-01D0074A; BMFT-RV14B7/74)
(MPE-Preprint-46; ISSN-0178-0719; ETN-86-98265) Copyright. Avail: Issuing Activity

Measurements of the plasma density obtained during the interaction of the artificial plasma jet fired into the ionosphere with the body of the PORCUPINE main payload were analyzed for times when there was a well-developed wake effect. The beam temperature found is four times less than the temperature at injection. This is explained by adiabatic cooling of the beam during its initial diamagnetic and current build-up phases at distances < 10 m. Outside this region the beam conserves the temperature achieved. The observation proves that the artificial plasma jet passes through an initial gas-like diamagnetic phase restricted to the vicinity of the beam source where it expands adiabatically. Partial cooling also takes place outside the diamagnetic region where the beam current still builds up. The observations also support a current-closure model of the quasi-neutral ion beam. ESA

N87-11605# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ANOMALOUS DIFFUSION ACROSS THE MAGNETIC FIELD-PLASMA BOUNDARY: THE PORCUPINE ARTIFICIAL PLASMA JET
E. V. Mishin, V. Ya. Kapitanov, and R. A. Treumann Feb. 1986 20 p
(MPE-Preprint-47; ETN-86-98208) Avail: NTIS HC A02/MF A01

Observations of nearly undisturbed penetration of the PORCUPINE dense and fast heavy ion beam into the magnetized ionospheric plasma after termination of the short adiabatic phase are discussed. Very fast magnetic field diffusion into the beam is requried. Collisional diffusion and instability of a sharp boundary between magnetic field and plasma yield diffusion times too long to account for the observations. The diffusion is therefore attributed to a transverse electron drift current driven electrostatic instability excited by the diamagnetic current flowing in the boundary layer between the injected beam and the ambient field. ESA

N87-11606# Naval Research Lab., Washington, D. C.
A COLLISIONAL-RADIATIVE MODEL AND SAHA DECREMENTS FOR A NONEQUILIBRIUM OXYGEN PLASMA
Ronald D. Taylor and A. W. Ali 20 May 1986 46 p
(AD-A168082; NRL-MR-5792) Avail: NTIS HC A03/MF A01 CSCL 20/9

When air is heated and becomes highly ionized, the primary constituents consist of nitrogen, oxygen and their ions. Emissions from this plasma provide diagnostic information as well as contribute to cooling the plasma. To describe such a plasma under nonequilibrium conditions one must know the population densities of various excited states. Using a time dependent approach a collisional-radiative model is developed for an oxygen plasma. Effective recombination and ionization coefficients are calculated for two specific cases, optically thin and optically thick in bound-bound UV radiation. The steady state population densities for neutral and ionic states are presented in terms of their deviations from Saha equilibrium predictions. These results show the approach of the plasma to a state of local thermodynamic equilibrium (LTE) as a function of electron temperatures between 1.0 and 3.0 eV and electron densities between 10 to the 16th power and 10 to the 19th power/cc. GRA

N87-11607# Pennsylvania State Univ., University Park.
STUDY OF PLASMA CONVECTION AND WALL INTERACTIONS IN MAGNETIC CONFINEMENT SYSTEMS Final Report, 1 Dec. 1984 - 28 Feb. 1986
T. M. York 1 Jun. 1986 160 p
(Contract DE-AC02-76ET-53018)
(DE86-011919; DOE/ET-53018/13) Avail: NTIS HC A08/MF A01

The subject contract research effort was initiated in September 1976 with two specific tasks: (1) to study the fundamental physics of confinement of an alternate concept (i.e., theta pinch based) devices; and (2) to study and to develop new diagnostic systems for use on major experiments at other locations in the country. There has been active collaboration with Los Alamos National Laboratory and Lawrence Livermore National Laboratory; there has

been proposed collaboration with Princeton Plasma Physics Laboratory, Fusion Research Center at the University of Texas, and General Atomics. DOE

N87-11608# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[ACTIVITIES REPORT OF THE INSTITUTE FOR PLASMA RESEARCH] Annual Report, 1985
1985 21 p
(ETN-86-98253) Avail: NTIS HC A02/MF A01

Electron cyclotron resonance heating waveguide systems and components for operation at 70 GHz were developed, constructed, and operated. The investigation of density fluctuations in connection with lower hybrid heating at ASDEX produced detectable scattering signals. Spectra of low frequency fluctuations were measured with good signal-to-noise ratios. Preparations for lidar scattering on JET proceeded. At the plasma focus experiment POSEIDON investigations of scaling laws, neutron production, particle acceleration mechanisms and the fine structure of the focus plasma have progressed. Indications of regimes with radiation collapse were observed. ESA

N87-11609# Paris-Sud Univ., Orsay (France). Lab. de Physique des Gaz et des Plasmas.
STUDY OF A DISCHARGE PRODUCED BY A STANDING SURFACE WAVE [ETUDE DUNE DECHARGE CREEE PAR UNE ONDE STATIONNAIRE]
Z. Rakem, E. Bloyet, C. Boisse-Laporte, A. Granier, P. Leprince, and J. Marec Jan. 1986 105 p In FRENCH; ENGLISH summary
(LP-213; ETN-86-98410) Avail: NTIS HC A06/MF A01

A microwave discharge was produced in argon gas at low pressures (0.5 to 3 torr) in capillary quartz tubes (diameter 3 to 5 mm). The discharge characteristics including neutrals temperature and density, electron density, and electric field and wave characteristics were determined. A model describing the wave propagation is given and compared to the experiment. The results allow a good description of this discharge type under the conditions of the experiment. ESA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N87-11610# International Centre for Theoretical Physics, Trieste (Italy).
SOME ASPECTS OF WAVE-FUNCTIONS IN DISORDERED AND INCOMMENSURATE MODELS
E. Roman and C. Wiecko Sep. 1984 16 p
(DE85-703226; IC-84/160) Avail: NTIS (US Sales Only) HC A02/MF A01

The localization length and fractal dimensionality of wave functions in the random diagonal and off-diagonal Anderson model are studied. This preliminary study is intended to establish how much connection between these two magnitudes exists and how they behave at the transition from the localized to extended regimes both in these random models as well as in the insommensurate models such as Aubry's. DOE

N87-11611# Sandia National Labs., Albuquerque, N. Mex.
CHEMICAL REACTION IN SHOCK COMPRESSION OF SOLIDS
R. A. Graham, B. Morosin, Y. Horie, and E. L. Venturini 1986 7 p Presented at the International Symposium on Intense Dynamic Loading and Its Effects, Beijing, China, 3 Jun. 1986 Prepared in cooperation with North Carolina State Univ., Raleigh.
(Contract DE-AC04-76DP-00789)
(DE86-003502; SAND-85-2411C; CONF-860616-8) Avail: NTIS HC A02/MF A01

The study of shock induced solid state chemistry is presented. Shock modification and chemical reaction were studied by various material probes. The BET method was used to determine the specific surface area. Computerized analysis of scanning electron microscope photographs determined the particle size distribution. Other material probes such as x-ray diffraction, electron spin resonance, transmission electron microscopy, thermal analysis with differential scanning calorimetry and differential thermal analysis as well as optical microscopy were used. DOE

N87-11612# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
IMPROVEMENT IN HIGH MAGNETIC FIELD BEHAVIOR OF VANADIUM-GALLIUM SUPERCONDUCTORS BY ENHANCEMENT OF SPIN-ORBIT SCATTERING Progress Report
P. M. Tedrow and R. H. Meservey 14 Feb. 1986 5 p
(Contract DE-FG02-84ER-45094)
(DE86-007857; DOE/ER-45094/3) Avail: NTIS HC A02/MF A01

Goal is to increase the critical magnetic field in V3Ga, by adding high Z impurities. V3Ga films 10 nm thick have been studied. A 6-nm Al over layer was found to optimize T sub c. 0.5 nm Ta overlayer also increased T sub c. There is zero field effect. Tunneling measurements on 10 nm V3Ga show important Fermi-liquid effects. DOE

N87-11613# Brookhaven National Lab., Upton, N. Y.
CRYSTALLOGRAPHY OF ICOSAHEDRAL CRYSTALS
P. Bak 1986 8 p Presented at the Winter School on Aperiodic Crystals, Les Houches, France, 11 Mar. 1986
(Contract DE-AC02-76CH-00016)
(DE86-009945; BNL-37962; CONF-8603112-1) Avail: NTIS HC A02/MF A01

The crystallography of icosahedral crystals is constructed. The actual three-dimensional crystal is represented by a three-dimensional cut in a regular six-dimensional periodic crystal with symmetry described by a six-dimensional space group, and the positions of atoms correspond to an arrangement of hypersurface segments. The resulting crystal cannot in general be viewed as a space-filling arrangemment of a small number of different Penrose tiles. The intensities of Bragg spots are given directly as the intensities of Bragg spots of the six-dimensional crystal. DOE

N87-11614# Stockholm Univ. (Sweden). Dept. of Physics.
ELECTRON TRANSPORT IN INTEGRAL PHOTOEMISSION X-RAY STANDING WAVE ANALYSIS
M. V. Kovalchuk and D. Liljequist Mar. 1986 20 p
(USIP-86-03; ETN-86-97853) Avail: NTIS HC A02/MF A01

Based on Monte Carlo simulations of electron transport, a simple formula for the escape probability P(z) of photoelectrons generated at depth z by an X-ray standing wave field is proposed. The transport theoretical background for this formula is discussed. ESA

N87-11615# Rolls-Royce Ltd., Derby (England). Materials Engineering Group.
COST EFFECTIVE SINGLE CRYSTALS
M. J. Goulette, P. D. Spilling, and R. P. Arthey 18 Feb. 1986 11 p
(PNR-90319; ETN-86-98021) Avail: NTIS HC A02/MF A01

Cost effectiveness constraints in aerospace single crystal technology were met by improving single crystal casting techniques, alloy development, and orientation measurement. The first led to the adoption of the technically more difficult seeding technique as a result of its greater flexibility. The second resulted in the development of a series of three alloys to meet specific turbine applications. The third requirement was met by the development of a rapid and accurate orientation Laue measurement technique (SCORPIO) suitable for the production environment. ESA

N87-11616# Rolls-Royce Ltd., Derby (England). Metallurgical Research Labs.
DEVELOPMENT OF SINGLE CRYSTAL ALLOYS FOR SPECIFIC ENGINE APPLICATIONS
D. A. Ford and R. P. Arthey 17 Feb. 1986 11 p
(PNR-90320; ETN-86-98022) Avail: NTIS HC A02/MF A01

A comprehensive family of alloys which meets the requirements of particular engine applications was developed. Alloy SRR is a high strength alloy to replace DS MM002 in applications where increased creep, tensile, and fatigue strength are required; RR2000 is designed for blades requiring low density or high impact resistance; RR2060 was developed as a nozzle guide vane alloy, with exceptional resistance to environmental attack and thermal fatigue. ESA

N87-11617# Rome Univ. (Italy). Dipt. di Fisica.
EFFECTIVE LANDAU THEORY FOR DISORDERED INTERACTING ELECTRON SYSTEMS: SPECIFIC HEAT BEHAVIOR
C. Castellani and C. DiCastro 21 Feb. 1986 12 p
(Preprint-500; ETN-86-97932) Avail: NTIS HC A02/MF A01

The frequency renormalization parameter of the generalized nonlinear sigma-model introduced to describe the interacting disordered electron system is identified in terms of the specific heat. This enables the effective Landau Fermi liquid picture for this system to be completed and to give the asymptotic behavior of the electronic specific heat in the various universality classes of the metal-insulator transition. ESA

N87-11618*# Mobil Tyco Solar Energy Corp., Waltham, Mass.
STRESS AND EFFICIENCY STUDIES IN EFG Quarterly Progress Report, Oct. 1 - 31 Dec. 1985
15 Jun. 1986 36 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-956312)
(NASA-CR-179814; DOE/JPL-956312/14; NAS 1.26:179814; DE86-012138) Avail: NTIS HC A03/MF A01 CSCL 20I

Modeling of the effect of transverse isotherm variation on residual stress has established that significant reductions in stress can be produced when the sheet edge is cooled with respect to the center. The potential to achieve large stress reductions exists but the quantitative details of the stress reductions depend on the creep relaxation. This is not known accurately in the region between 800 C and 1200 C where the residual stress is very sensitive to the transverse isotherm curvature. An apparatus for measurement of stress relaxation in silicon at these temperatures has been built and tested and will be used to examine creep behavior in more detail under a continuation contract. EBIC characterization of dislocated FZ silicon stressed at high temperatures has established correlations between the bulk minority carrier diffusion length and the dislocation density. Other results suggest that stress applied during annealing will influence diffusion length degradation arising from thermal effects. Studies of dislocation electrical activity as a function of dopant concentration indicate that increased dopant concentrations lead to a wider region of low current collection around the dislocation. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N87-11619*# Virginia Univ., Charlottesville. Dept. of Materials Science.
A STUDY OF THE APPLICABILITY OF NUCLEATION THEORY TO QUASI-THERMODYNAMIC TRANSITIONS OF SECOND AND HIGHER EHRENFEST-ORDER, SUPPLEMENT 3 Final Report
R. E. Barker, Jr. Jul. 1986 17 p
(Grant NAG1-419)
(NASA-CR-179836; NAS 1.26:179836; UVA/528320/MS87/103-Supp-3) Avail: NTIS HC A02/MF A01 CSCL 20M

The work includes an investigation of the applicability of the nucleation theory to second and higher order thermodynamic transitions in the Ehrenfest sense, and a number of significant conclusions relevant to first order transitions, as well. The underlying theoretical method consisted of expanding the Gibbs' free energy in a Maclarin or Taylor series and then using fundamental thermodynamic determinable quantities, and interpreting the results. Work was performed on the existence and interpretation of an interfacial energy between phases in a second order transition in addition to an investigation of the solid-liquid interfacial energy for various polymers. Extensive considerations were devoted to various aspects of a particular polymer, polyvinylidene fluoride (PVDF or PVF2), including an experimetal investigation of the effects of an applied electric field on the morphology of melt crystallization and on the nucleation and growth of polarized domains. Author

N87-11620# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
THE DYNAMICALLY COMPRESSED METALLIC STATE: THEORY Final Report, 1 Sep. 1982 - 31 Jan. 1986
N. W. Ashcroft 15 Apr. 1986 7 p
(Contract DAAG29-82-K-0170)
(AD-A169174; ARO-18867.7-PH) Avail: NTIS HC A02/MF A01 CSCL 20/13

This research has combined two major themes: the statistical mechanics of classical systems under conditions typical of shock or explosive environments, and the quantum statistical mechanics of inhomogeneous electron systems embedded in these classical ensembles. The project began with an application of the thermodynamics and structure of the liquid state, but applied in the context of a dynamic solid. The method developed allowed us to reduce Hugoniot data to isotherms without the necessity of invoking any Gruneisen type of law. It was constructed explicitly for the case of insulating systems, but we were already able to see a possible modification for metals. A system that seemed to remain very much an insulator under severe dynamic loading was SiO2, whose band structure (in the fluorite phase) we calculated using the self-consistent augmented spherical wave method. Pressure as a general indicator of trends in electronic structure appears to be a tool of increasing value and versatility. When high pressures are generated by shock methods, there is usually an accompanying increase in temperature, often very substantial. For nuclear driven shocks these temperatures can become so high that an electron system is driven far from degeneracy. GRA

N87-11621# Princeton Univ., N. J. Dept. of Chemical Engineering.
ANALYSIS OF THE DISPERSION FORCE BETWEEN A LAYERED SPHERE AND A CYLINDER Contract Report, Jul. 1984 - Jul. 1985
Dennis C. Prieve and William B. Russel May 1986 45 p
(AD-A169444; CRDEC-CR-86038) Avail: NTIS HC A03/MF A01 CSCL 20/3

The continuum theory developed by Lifshitz and coworkers predicts the van der Waals forces acting between colloidal or macroscopic bodies from knowledge of the dielectric spectra of the individual materials. Formal exact solutions, accounting for the effect of retardation, exist for planar geometries such as flat plates and multilayers and discrete particles such as spheres and cylinders. Each comprises a complicated nested set of sums and/or integrals over a spectrum of wavenumbers and frequencies of the fluctuating electromagnetic modes. The power of the theory lies in the natural accommodation of the many-body effects responsible for the quantitative failure for condensed media of the pairwise additive Hamaker theory. The price is the need for complete dielectric spectra for the component materials and involved numerical calculations which obscure the relationship between these dielectric properties and the essential features of the force. This report contains the analysis of and numerical results for the dispersion force between a coated cylinder and sphere based on rigorous expressions available from the Lifshitz theory for interactions between half spaces. The Derjaguin approximation satisfactorily accounts for the curvature of the bodies since the dimensions are large with respect to the relevant wavelengths. GRA

N87-11622# Stanford Linear Accelerator Center, Calif.
SUPERSTRINGS AND GEOMETRY OF SUPERSPACE
A. Dhar May 1986 13 p Presented at the Tata Institute Winter School on Theoretical Particle Physics, Panchgani, India, 25 Jan. 1986
(Contract DE-AC03-76SF-00515)
(DE86-012044; SLAC-PUB-3961; CONF-860175-1) Avail: NTIS HC A02/MF A01

These lectures present some recent developments in the sigma-model approach to the Green-Schwarz superstring. Among the topics included are: (1) interpretation of the free superstring as a flat superspace sigma-model; (2) propagation of the superstring in curved superspace; and (3) in the presence of background super Yang-Mills fields. The role of the world-sheet fermionic gauge symmetry needed to ensure consistent coupling to background fields is emphasized. DOE

N87-11623# Rome Univ. (Italy). Dipt. di Fisica.
AN ALTERNATIVE PROOF OF ULTRAVIOLET STABILITY OF THE TWO-DIMENSIONAL MASSIVE SINE GORDON FIELD THEORY IN ALL REGIONS OF COLLAPSE
J. Renn and A. Steinmann 12 Nov. 1985 32 p Sponsored by Studienstiftung des Deutschen Volkes, and Schweizerischer Nationalfonds
(Nota-Interna-855; ETN-86-97889) Avail: NTIS HC A03/MF A01

The upper bound for the ultraviolet stability of the two dimensional cosine interaction in finite volume is proven for alpha epsilon 4 pi, 8 pi where the theory is super-renormalizable. Ultraviolet stability in this interval is proved using renormalization group methods based on a multiscale decomposition of the field by showing that the large fluctuations may be controlled by their small probability. ESA

N87-11624# Rome Univ. (Italy). Dipt. di Fisica.
AN ALTERNATIVE MODEL FOR THE DENSITY OF STATES IN THE QUANTUM HALL EFFECT
M. Giura, R. Fastampa, and R. Marcon 18 Dec. 1985 11 p Sponsored by Ministero della Pubblica Istruzione, Rome, Italy Prepared in cooperation with CNR, Rome, Italy
(Nota-Interna-858; ETN-86-97892) Avail: NTIS HC A02/MF A01

A model of the density of states in the electron dispersion law in two-dimensional conductors with a weak random potential is presented. It is based on the existence of a critical point of saddle type. The model is used to explain the quantum Hall effect. ESA

N87-11625# Rome Univ. (Italy). Dipt. di Fisica.
PROBABILISTIC SOLUTIONS OF GENERALIZED BIRTH AND DEATH EQUATIONS AND APPLICATION TO NONRELATIVISTIC ELECTRODYNAMICS
M. Serva 2 Dec. 1985 26 p
(Preprint-483; ETN-86-97918) Avail: NTIS HC A03/MF A01

Probabilistic solutions to the equations describing nonrelativistic quantum electrodynamical systems are presented. The solutions involve, besides the usual diffusion processes, birth and death processes corresponding to the photon number variables. Inequalities are stated, and bounds to the ground state energy of systems composed by a nonrelativistic particle interacting with a field are established. The result is general and is applied as an example to the polaron problem. ESA

N87-11421 Deutscher Wetterdienst, Offenbach am Main (West Germany).
THERMODYNAMIC ASPECTS OF THE ABSORPTION OF GAS IN DROPLETS [THERMODYNAMISCHE ASPEKTE DER GAS-AUFNAHME IN TROPFEN]
Ulrike Wacker *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment 1986 p 133-134 In GERMAN (For primary document see N87-11367 02-47)
Avail: Issuing Activity

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N87-11626# Pacific Northwest Labs., Richland, Wash.
EXPERIENCES WITH A DATA ANALYSIS MANAGEMENT PROTOTYPE
P. J. Cowley, D. B. Carr, and W. L. Nicholson Apr. 1986 6 p Presented at the 18th Symposium on the Interface of Computer Science and Statistics, Fort Collins, Colo., 20 Mar. 1986
(Contract DE-AC06-76RL-01830)
(DE86-011615; PNL-SA-13820; CONF-8603103-2) Avail: NTIS HC A02/MF A01

This paper presents an evaluation of a prototype data analysis management system. This system was designed to aid the analyst in keeping track of the course of a data analysis. Evaluated features include capabilities to graphically depict the course of the analysis to return to previous milestones in the analysis, the ability to use segments of the log that describe the course of the analysis, and the ability to associate both written and spoken documentation with milestones of the analysis. DOE

N87-11627# Rolls-Royce Ltd., Derby (England).
ENGINEERS: CAN THEY BE MANAGED?
G. Walker 6 Mar. 1986 21 p Presented at Royal Aeronautical Society, Bristol, England, 21 Oct. 1985
(PNR-90307; ETN-86-98018) Avail: NTIS HC A02/MF A01

The advantages of involving engineers in management are discussed. Examples from the aerospace industry are used to illustrate these advantages. ESA

N87-11628# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
THE INTERFACE WITH DECISION MAKERS AND SOME EXPERIMENTAL RESULTS IN INTERACTIVE MULTIPLE OBJECTIVE PROGRAMMING METHODS
M. Kok 1985 29 p Presented at 2nd Euro Summer Inst. on Multi-Criteria Analysis, Brussels, Belgium, 12 Jul. - 2 Aug. 1985 Sponsored by Ministry of Economic Affairs
(Rept-85-36; ETN-86-98466) Avail: NTIS HC A03/MF A01

The basic concepts of interactive methods in multiple objective linear programming are discussed. The underlying mathematical formulation is investigated. It turns out that these methods are all based on three different types of scalarization. This explains the exchange of information (the interface) between the decision makers and the model. Problems in designing this interface are investigated using results from psychology concerning the ability of a human being to oversee a large number of stimuli. Experiments with a model of a national energy system, and conclusions concerning the use of interacitve methods in long-term planning are presented. ESA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N87-11629# General Accounting Office, Washington, D. C. Information Management and Technology Div.
DATA MANAGEMENT: DoD SHOULD REDIRECT ITS EFFORTS TO AUTOMATE TECHNICAL DATA DEPOSITORIES
Mar. 1986 45 p
(AD-A168095; GAO/IMTEC-86-7) Avail: NTIS HC A03/MF A01 CSCL 15/5

The Department of Defense's (DOD) technical data repositories (storage centers) are critical to increasing competition in DOD's approximately $22-billion annual spare-parts procurement process. Technical data include the specifications, engineering drawings, descriptions of manufacturing processes, and testing procedures necessary to competitively procure spare parts. Concern about DOD's technical data problems and their effect on competition for spare-parts procurements prompted the Chairman of the House Committee on Government Operations to ask GAO to determine whether: 1) DOD's management of technical data repository automation efforts is adequate and whether these efforts should be consolidated into a single program managed at the DOD level; 2) current repository automation efforts by the military departments and the Defense Logistics Agency are well defined, are based on validated requirements, and have used appropriate procurement methods; and 3) DOD and the Patent and Trademark Office should share studies (to include testing) of new technology. GRA

N87-11630# Logistics Management Inst., Bethesda, Md.
MICROCOMPUTER-BASED LOCAL AUTOMATION MODEL: SYSTEM PLANNING GUIDANCE
Richard W. Hartt and Dennis J. OConnor May 1986 24 p
(Contract MDA903-85-C-0139)
(AD-A168136; LMI-DL503; DTIC-TR-86/13) Avail: NTIS HC A02/MF A01 CSCL 05/2

Guidance is provided to Department of Defense libraries and information centers on implementing the microcomputer-based Local Automation Model, an integrated library system that includes intelligent gateway technology to search, download, analyze, merge and output citations from multiple databases. The document draws on the experience gained in implementing the micro-Lam prototype at the Technical Library, Headquarters US Army Training and Doctrine Command (HQ TRADOC) and provides an outline of tasks to be addressed in implementing the system at other installations. Tasks include deciding which functions to automate, determining requirements for peripheral equipment, and analyzing telecommunications and electrical requirements. Cost estimates for the system are also included. GRA

N87-11631# Politecnico di Milano (Italy). Dipt. di Elettronica.
TRANSLATION AND OPTIMIZATION OF LOGIC QUERIES: THE ALGEBRAIC APPROACH
S. Ceri, G. Gottlob, and L. Lavazza 1986 36 p
(Rept-86-004; ETN-86-97939) Avail: NTIS HC A03/MF A01

A syntax directed translation is developed from rules of function-free logic programs to algebraic equations independent equations solved using a closure operator and systems of interdependent equations by a substitution method. Such solutions define the operational and fixpoint semantics of function-free logic programs and queries operating on a data base. The algebraic approach enables use of traditional results of query optimization in the optimization of a logic query. Top-down and bottom-up strategies are presented. The former are useful if no initial binding is provided with the query; the latter are useful if arguments of the query are bound to constant values. The strategies developed in this way can be efficiently executed on algebraic data base machines. ESA

N87-11632# SYSTAN, Fraenkisch-Crumbach (West Germany).
SUPPORT FOR THE DESIGN AND THE IMPLEMENTATION OF THE SPACECRAFT PERFORMANCE EVALUATION SERVICES
H. M. Rupp Paris ESA 30 Sep. 1985 40 p
(Contract ESA-5868/84-D-IM(SC))
(ESOC/85/1; ESA-CR(P)-2210; ETN-86-98093) Avail: NTIS HC A03/MF A01

The implementation of Spacecraft Performance Evaluation Services (SPES) to provide user oriented services is described. By acquiring practical experience using a standard commercial database management system in ESOCs space data environment, ESOC examined whether such products are suitable to support requirements stemming from the handling of telemetry and related data structures. By using PISA/DB (formerly called PEDMS) as the data management component in SPES, this product was evaluated. The SPES was designed in detail and sections of SPES were implemented, incorporating PISA/DB as the essential data management tool. Results show that PISA/DB is useful, and relatively fast and versatile. ESA

N87-11633# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
MAKING A SIMPLE RELATIONAL DATABASE SYSTEM
Peter vanEijk and Matthijs Kuiper Oct. 1984 11 p
(INF-84-18; ETN-86-98159) Avail: NTIS HC A02/MF A01

The managing of a project to implement a simple data base management system by a group of students is described. The project was finished in time and the system produced is operational, although without sophisticated features. ESA

N87-11634# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
MINIMIZING THE RESPONSE TIME OF A QUERY IN A DISTRIBUTED DATA BASE
Peter M. G. Apers Dec. 1985 29 p
(INF-85-26; ETN-86-98174) Avail: NTIS HC A03/MF A01

To minimize response time in distributed data bases, a two-phase optimization is proposed: a logical optimization, and a physical optimization to map an operation graph produced by the logical optimizer into a schedule for a finite set of resources having a non-zero service speed. This approach is explained in the context of minimizing the response time of queries with Boolean predicates. Simulation-results indicate that the optimization produces very efficient schedules. ESA

N87-11635# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Informatics.
A MODELING APPROACH TO INFORMATION SYSTEM DEVELOPMENT
L. J. B. Essink Dec. 1985 35 p
(INF-85-29; ETN-86-98175) Avail: NTIS HC A03/MF A01

A taxonomy of information system design decision is presented. The framework can be regarded as a paradigm for the development of methodologies and an instrument to integrate parts of several methodologies Four levels of abstraction and eight aspects to model at each level are introduced. A holistic and problem independent methodology supports the modeling regarding all the specified design areas by an analysis framework and descriptive means. The use of model cycles directed to the goals of each level, results in a good level of separability of concern. (The designer's attention is focussed on a specific aspect on a specific level and the results of the modeling process can first be communicated separatly and later as a part of an integrated system model). Each level has its own concepts and it is clear at which level an aspect is depicted. So, a good level of separability of concepts is achieved. ESA

N87-11636# Logica Ltd., London (England). Aerospace Group.
AUTOMATED INFORMATION RETRIEVAL SYSTEM FOR SATELLITES (AIRS). PART 1, CHAPTER 2: DESIGN PHASE

Executive Summary
R. J. Peberdy Paris ESA 1 Jun. 1984 23 p
(Contract ESTEC-5731/83-NL-BI)
(Rept-71.4601; ESA-CR(P)-2212; ETN-86-98094) Avail: NTIS HC A02/MF A01

A data base containing technical, industrial, and operational information on all space systems and their associated Earth stations was designed. It includes all relevant information obtainable from the International Frequency Registration Board (IFBR) documents. Communications and Earth-observation satellites are emphasized. The software necessary to access and maintain the data base and to enable rapid response to general queries whereby information may be presented as a report or used in ESA applications programs; and monitoring of, and response to, the requirements for intersystem coordination of the radio spectrum usage as specified by the IFBR was investigated. ESA

N87-11637# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
CONST: A CONSTRUCTIVE APPROACH TO INFORMATION MODELING
Bengt G. Lundberg 1985 26 p
(Rept-85-44; ETN-86-98474) Avail: NTIS HC A03/MF A01

An approach to information modeling based in the principles of a constructive theory and the formalism of production rules is presented. A constructive approach concerning the nature and representation of abstract objects is taken. The cognitive, formal and metaphysical advantages are discussed, and examples employing the constructive approach are presented. ESA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N87-11638# Battelle Inst., Frankfurt am Main (West Germany). Applied Economics Center.
SOLID EARTH SATELLITE: MARKET, COST AND BENEFITS STUDY Final Report
Paris ESA Oct. 1985 131 p Prepared in cooperation with Dornier-Werke G.m.b.H. Friedrichshafen, West Germany, Intelplan SA, Deutsches Geodatisches Forschungsinstitut, Stuttgart Univ., West Germany, and CNES, Toulouse, France
(Contract ESA-5756/83-F-FC(SC))
(ESA-CR(P)-2213-Vol-1; ETN-86-98095) Avail: NTIS HC A07/MF A01

Potential markets for POPSAT-derived final products/services were evaluated in a survey of possible applications and their priorities, and through the identification of type and motivation of the potential final users of such systems. The value of the market for POPSAT-derived final products/services in terms of economic, scientific, and social benefits was determined. Quantitative benefit/cost ratios (where applicable) and realistic qualitative statements for those application areas where a quantification turns out to be impossible were derived. Results suggest that potential users do not have a sufficient knowledge of POPSAT capabilities. This community, which includes scientific, governmental, and commercial organizations, is still not able to formulate a definitive opinion on the value of the system. While scientific institutes are in the best position to gather information, there is no doubt that POPSAT is also in a position to satisfy public and commercial enterprises. ESA

N87-11639# Battelle Inst., Frankfurt am Main (West Germany).
SOLID EARTH SATELLITE: MARKET, COST AND BENEFITS STUDY Executive Summary
Paris ESA Oct. 1985 17 p
(Contract ESA-5756/83-F-FC(SC))
(ESA-CR(P)-2213-Vol-2; ETN-86-98096) Avail: NTIS HC A02/MF A01

Potential markets for POPSAT-derived final products/services were evaluated in a survey of possible applications and their priorities, and through the identification of type and motivation of the potential final users of such systems. The value of the market for POPSAT-derived final products/services in terms of economic, scientific, and social benefits was determined. Quantitative benefit/cost ratios (where applicable) and realistic qualitative statements for those application areas where quantification turns out to be impossible were derived. ESA

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N87-11640# Committee on Science and Technology (U. S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1987
Washington GPO 1986 251 p Report to accompany H.R. 5495 presented by the Committee on Science and Technology to the Committee of the Whole House on the State of the Union, 99th Congress, 2d Session, 16 Sep. 1986
(H-Rept-99-829; GPO-58-629) Avail: US Capitol, House Document Room

Authorization of appropriations to the National Aeronautics and Space Administration for the fiscal year 1987 for research and development; space flight, control, and data analysis; construction of facilities; and research and program management is discussed. B.G.

N87-11641# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION BILL, 1986
1986 26 p A bill, H.R. 5495, referred to the Committee on Science and Technology, 99th Congress, 2d Session, 10 Sep. 1986
(H-Rept-99-829) Avail: US Capitol, House Document Room

Authorized appropriations are summarized for the National Aeronautics and Space Administration for the following: permanently manned space station; space transportation capability development; physics and astronomy; life sciences; planetary exploration; solid earth observations; environmental observations; materials processing in space; communications; information systems; technology utilization; commercial use of space; transatmospheric research and technology; tracking and data advanced systems; space flight, control, and data communication; construction of facilities, including land acquisitions; and research and program management. B.G.

N87-11642# Committee on Appropriations (U. S. Senate).
NASA SPACE PROGRAM
Washington GPO 1986 226 p Hearings before Subcommittees of the Committee on Appropriations, 99th Congress, 2d Session, 25-26 Mar. 1986
(S-Hrg-99-691; GPO-60-030) Avail: Committee on Appropriations

Topics discussed in depth include: industrial utilization and commercialization of space technology; environmental and earth science applications of space technology; intrinsic human values of space explorations; and access to space. B.G.

N87-11643# Committee on Science and Technology (U. S. House).
THE 1987 NASA AUTHORIZATION, VOLUME 1
Washington GPO 1986 171 p Hearings before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, 99th Congress, 2d Session, No. 92, 9 Apr. 1986
(GPO-60-960) Avail: Subcommittee on Transportation, Aviation and Materials

The appropriations for the National Aeronautics and Space Administration's fiscal year 1987 aeronautics and transatmospheric reasearch and technology buget requests are examined. B.G.

N87-11644# Army War Coll., Carlisle Barracks, Pa.
THE STRATEGIC DEFENSE INITIATIVE
W. L. Mills 14 Apr. 1986 28 p
(AD-A168147) Avail: NTIS HC A03/MF A01 CSCL 15/3

The Strategic Defense Initiative (SDI) is a research program in which President Reagan asked key scientists and technological leaders to conduct research aimed at determining whether there are cost-effective defensive technologies that could improve the deterrent capability of the United States and allies. The concept of the SDI program envisions a layered defense where hostile missiles could be attacked shortly after launch during the boost and postboost phase, individual attack on the warheads themselves or attack as they approach the end of their flight. Standard arguments for and against the SDI program were examined. Information was gathered using a review of the literature and through analysis of the views of key military and civilian leaders. While it has been argued that a US SDI program will cause instability rather than promote stability, it must be realized that the Soviet Union has been emphasizing defense and survivability and has been pursuing an extensive SDI program for many years. The SDI program facilitated dialogue and negotiations between the United States and the Soviet Union as well as has the potential to enhance our basic defense strategy of deterrence. The program was in part responsible for the successful Geneva Summit meetings in November 1985. The US Congress, the elections of 1988 and US public opinion will play a significant role in the future of the SDI program. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N87-11645# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES, VOLUME 40, NUMBER 7 Monthly Report
C. J. Fox Jul. 1986 39 p
(AD-A168089) Avail: NTIS HC A03/MF A01 CSCL 05/2

European Science Notes is a monthly publication with brief articles on recent developments in European scientific research. A partial list of its contents includes the following: Life Sciences Research at the Inst. for Biochemistry, Free Univ. of Berlin; Research at the Inst. for Biochemistry and Molecular Biology, Technical Univ. of Berlin; Artificial Intelligence Activities at Bristol's New Information Technology Research Center; Fluid Mechanics at the National Aerospace Lab in the Netherlands; Turbulence Research at the Delft Hydraulics Lab.; Turbulence Research at the Eindhoven Univ. of Technology and at the Institut de Mechanique des Fluides de Lille; Oceanography Research at Two UK Universities. GRA

N87-11646# Department of Energy, Washington, D. C.
PROGRAMS OF THE OFFICE OF ENERGY RESEARCH
Apr. 1986 28 p
(DE86-009937; DOE/ER-0191-3) Avail: NTIS HC A03/MF A01

The programs of the Office of Energy Research, DOE, include several thousand individual projects and hundreds of laboratories, universities, and other research facilities throughout the United States. The major programs and activities are described briefly, and include high energy and nuclear physics, fusion energy, basic energy sciences, and health and environmental research, as well as advisory, assessment, support, and scientific computing activities. DOE

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N87-11647 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DIAMAGNETIC EFFECT AND ANOMALOUS TRANSPORT IN EXPANDING PLASMA CLOUDS Active Magnetic Particle Tracer Explorers Reports
C. T. Dum Mar. 1984 31 p
(MPE-Preprint-26; ASP-08; ISSN-0340-8922; ETN-86-98206) Avail: Issuing Activity

Kinetic and instability effects for the diamagnetic phase of magnetospheric barium releases are explored. By anomalous transport, chiefly from ion sound turbulence, electrons are considered as a fluid while Ba ions are treated as particles. This model is compared to predictions of ideal and resistive MHD. Electron dynamics modifies radial profiles, and allows for effects such as the generation of azimuthal magnetic fields and associated poloidal (Hall) currents near the ends of the elongated plasma cloud, by the combined action of radial and axial expansion. Propagation of shear Alfven waves in flux tubes of the ambient plasma may be initiated. Ion distributions should exhibit axially accelerating ion fronts, radial deceleration and reflection, azimuthal differential spinup, and large pressure anisotropies. The diffuse plasma halo and contamination by the ambient plasma is important for instabilities. The ionization process is expected to have a considerable effect in the diamagnetic phase. ESA

N87-11648 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DATA ACQUISITION AND EVALUATION ELECTRONICS FOR THE ROSAT POSITION SENSITIVE PROPORTIONAL COUNTERS (PSPC'S)
G. Metzner May 1985 16 p Submitted for publication
(MPE-Preprint-33; ETN-86-98207) Copyright. Avail: Issuing Activity

Front-end and evaluation electronics for the ROSAT position sensitive proportional counters (PSPC) were designed and built. For each accepted X-ray event in the energy range from 0.1 to 2.0 keV, the energy and the arrival time, and the location are determined. In order to reduce the telemetry data rate, the event location is calculated on board. An electronic background suppression system for charged particles was incorporated. With this system, a suppression efficiency of 97.5% is measured. With a five-sided anticoincidence, 99% is achieved. Each of the PSPC's, of which only one at a time is active, contains its own charge sensitive amplifiers and pulse shapers. The analog signals of the PSPC's are mixed and routed to the commonly used analog evaluation electronics and the microcomputer. In order to reduce the number of peak detectors and analog to digital converters, the signals are multiplexed. Up to 1000 events/sec can be evaluated. ESA

N87-11649 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE POSITION SENSITIVE PROPORTIONAL COUNTER (PSPC) OF THE ROSAT TELESCOPE
U. G. Briel and E. Pfeffermann May 1985 13 p Submitted for publication
(MPE-Preprint-32; ETN-86-98238) Copyright. Avail: Issuing Activity

A position sensitive proportional counter for X-rays in the energy range from 0.1 to 2.0 keV was developed and tested for the prime focal instrument of the ROSAT X-ray telescope. Over the entire sensitive circular area of 80 mm diameter, the energy resolution for 0.93 keV X-rays is 45%. Local deviations of the gas gain from the mean value is < 3%. For X-ray energies of 0.93 and 0.28 keV, the mean position resolution is 250 and 400 microns (FWHM) respectively. When correcting the position of each X-ray event, differences between the nominal and the measured position of pinholes of < 20 micron are achieved. Operating the PSPC in the environment of a Co-60 gamma-ray source, an overall background rejection of > 99% is attained. ESA

N87-11650 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
GAMMA RAY ASTRONOMY FROM SATELLITES AND BALLOONS
Volker Schoenfelder Sep. 1985 20 p Presented at 19th ICRC, La Jolla, Calif., 11-23 Aug. 1985
(MPE-Preprint-39; ETN-86-98260) Copyright. Avail: Issuing Activity

Satellite and balloon observations of cosmic gamma rays are summarized. The MeV-emission of gamma ray bursts is a common feature. Variations in duration and energy spectra from burst to burst may explain the discrepancy between the measured log N-log S dependence and the observed isotropy of bursts. The gamma ray line at 1.809 MeV from A26 is the first detected line from a radioactive nucleosynthesis product. To understand its origin it is necessary to measure its longitude distribution in the Milky Way. Indication of a gamma ray excess from the direction of Loop I is consistent with the picture that the bulk of cosmic rays below 100 GeV is produced in galactic supernova remnants. The interpretation of the large scale distribution of gamma rays in the Milky Way is controversial. An extragalactic origin of the cosmic ray nuclei in the GeV-range cannot be excluded from the gamma ray data. The detection of MeV-emission from Cen A is a promising step towards extragalactic gamma ray astronomy. ESA

N87-11651*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMBINED ULTRAVIOLET STUDIES OF ASTRONOMICAL SOURCES Semiannual Progress Report, 1 Feb. - 31 Jul. 1986
S. L. Baliunas, A. K. Dupree, M. Elvis, J. P. Huchra, S. Kenyon, and J. C. Raymond Oct. 1986 11 p
(Grant NAG5-87)
(NASA-CR-179784; NAS 1.26:179784; SAPR-12) Avail: NTIS HC A02/MF A01 CSCL 03A

Topics addressed include: Cygnus Loop; P Cygni profiles in dwarf novae; YY Gem; nova shells; HZ Herculis; activity cycles in cluster giants; Alpha Ori; metal deficient giant stars; ultraviolet spectra of symbiotic stars detected by the Very Large Array; time variability in symbiotic stars; blue galaxies; and quasistellar objects with X-ray spectra. B.G.

N87-11652*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
FAR-INFRARED SPECTRAL STUDIES FROM THE G. P. KUIPER AIRBORNE OBSERVATORY Final Technical Report, 1 Oct. 1978 - 31 Oct. 1986
Martin Harwit Oct. 1986 8 p
(Grant NsG-2347)
(NASA-CR-179879; NAS 1.26:179879) Avail: NTIS HC A02/MF A01 CSCL 03A

The grant to carry out far-infrared spectral studies of astronomical sources from the G. P. Kuiper Airborne Observatory was first funded in October 1978 and officially ended on October 31, 1986. During these eight years, A variety of previously undetected spectral lines was discovered, and these were used to determine the physical and chemical conditions prevailing in regions of active star formation. They served to clarify the nature of the ionized hydrogen regions often adjacent to star-forming clouds, the characteristics of shocks which may signify the onset of star formation, and the nature of coolants that channel away energy thus enabling a cloud to collapse to form new stars. Author

N87-11653*# North Carolina Univ., Chapel Hill. Dept. of Physics and Astronomy.
UV OBSERVATIONS OF BLUE STRAGGLERS AND POPULATION 2 K DWARFS Final Technical Report, 1 Jul. 1984 - 30 Jun. 1986
Bruce W. Carney and Howard E. Bond (Louisiana State Univ., Baton Rouge.) 1986 4 p
(Grant NAG5-424)
(NASA-CR-179865; NAS 1.26:179865) Avail: NTIS HC A02/MF A01 CSCL 03A

Blue stragglers are stars, found usually in either open or globular clusters, that appear to lie on the main sequence, but are brighter and bluer than the cluster turn-off. Currently, two rival models are invoked to explain this apparently pathological behavior: internal mixing (so that fresh fuel is brought into the stellar core); and mass transfer (by which a normal main sequence star acquires mass from an evolving nearby companion and so moves up the main sequence). The latter model predicts that in the absence of complete mass transfer (i.e., coalescence), blue stragglers should be binary systems with the fainter star in a post-main sequence evolutionary state. It is important to ascertain the cause of this phenomenon since stellar evolution models of main sequence stars play such a vital role in astronomy. If mass transfer is involved, one may easily exclude binaries from age determinations of clusters, but if mixing is the cause, our age determinations will be much less accurate unless we can determine whether all stars or only some mix, and what causes the mixing to occur at all. Author

N87-11654# Borer Electronics A.G., Solothurn (Switzerland).
STUDY OF THE FEASIBILITY OF A CHANNEL MULTIPLEXER OPERATING AT CRYOGENIC TEMPERATURES Final Report
C. Moldovan Paris ESA Nov. 1985 97 p
(Contract ESTEC-6071/84-NL-BI(SC))
(RPT/CRY/62351/BO; ESA-CR(P)-2208; ETN-86-98092) Avail: NTIS HC A05/MF A01

The feasibility of a signal multiplexer able to operate in cryogenic (4 to 100 K) and radiation (20 kRad) environments, namely the cryostat vessel of the ISO mission, is shown. The proposed multiplexing option can be considered useful only if the overall analog multiplexing system significantly reduces the thermal input in the cryostat vessel. This occurs via 300 electrical interconnections which must be made from the electronic units located outside the cryostat to sensors and actuators inside the cryostat vessel. The feasability and efficiency of the multiplexer system is demonstrated. Based on a technology survey, three potential solutions can be retained: GaAs MESFET technology, silicon MOS technology, and silicon micromechanical membrane switches. ESA

N87-11655# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HIGH ALTITUDE RESEARCH ROCKET PROGRAM ASTRONOMY: PAYLOAD INTER-ZODIAK. REPORT ON SYSTEM DEVELOPMENT, INTEGRATION, TESTING, AND FLIGHT [HOEHENFORSCHUNGSRAKETENPROGRAMM ASTRONOMIE NUTZLAST INTER—ZODIAK, BEREICHT UEBER SYSTEMTWICKLUNG, INTEGRATION, TEST UND FLUG]
Manfred Boison, Gerhard Neumann, and Walter Schnattinger Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 277 p Partly in ENGLISH and GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie and DFVLR
(BMFT-FB-W-85-025; ISSN-0170-1339; ETN-86-97844) Avail: NTIS HC A13/MF A01; Fachinformations-zentrum, Karlsruhe, West Germany DM33

A rocket program to investigate H and He-atoms excited by extreme ultraviolet (EUV) radiation, with emphasis on the analysis of the zodiacal EUV resonance fluorescence is introduced. Requirements, mechanical construction, attitude control and measurement, and qualification of the payload are described. The procedure of the project, and the launching campaign are

presented. The evolution of the mission and the test data evaluation are discussed. ESA

N87-11656 Columbia Univ., New York.
OBSERVATIONS OF CORONAL X-RAY SOURCES AND AN ANALYSIS OF THE STELLAR CONTRIBUTION TO THE SOFT X-RAY BACKGROUND Ph.D. Thesis
Jean-Pierre Caillault 1985 158 p
Avail: Univ. Microfilms Order No. DA8604607

To establish the prevalence of X-ray emission among field stars, we have conducted a systematic search of over 1700 stars brighter than 10th magnitude observed by the Einstein Observatory. Fewer than 4% of the stars were detected at a limiting flux value of approx. 10(-13) ergs cm(-2)s(-1). We use the observed distribution of X-ray to optical flux ratios for both the detected and undetected stars to limit the X-ray luminosity function for field stars of all spectral types. We have also conducted an extensively soft X-ray survey of the Pleiades open cluster using Einstein. The most luminous G-stars require a substantially different coronal structure than that found on the Sun; a larger scale length for coronal loops may be partially responsible for these high luminosites. The lack of rotational modulation of the emission from most of the late-type stars requires the presence of numerous active regions distributed more uniformly than is the case in the solar corona. A map of the soft X-ray emission along a galactic meridian within +/- 3 deg. of the galactic plane is presented. We find an excess of diffuse M-band emission at low latitudes which exhibits a resolved, double-peaked profile that is roughly symmetric about b(parallel) = 0 deg. with a half-width approx. 1 to 2 deg. We model this component to derive constraints on the scale-height and volume emissivity of the X-ray emitting material. We have carried out a systematic optical identification program of serendipitous X-ray sources discovered by Einstein; eleven of these sources are dM-stars. Dissert. Abstr.

N87-11657 Wisconsin Univ., Madison.
HIGH RESOLUTION SPECTROSCOPY OF RS CVn STARS Ph.D. Thesis
Zeki Eker 1985 127 p
Avail: Univ. Microfilms Order No. DA8601096

High resolution echelle-Reticon observations covering all orbital phases of the bright RS CVn stars sigma Gem and HR 5110 have been obtained. Nine spectra with 0.16 A resolution show that the core of H alpha in sigma Gem varies with orbital phase in agreement with the spot zones identified by Fried et al. (1983) and also that the H alpha brightness of a zone changes in time. Neutral metal lines in the same echelle order have been studied to investigate the properties of the spots. A new method is described to determine soot areas and temperatures from temperature-sensitive metal lines. The lack of observed metal line variation in the normal spot zones requires a temperature difference between spot and photosphere greater than 1000 K and spot area less than 20% of the disk. Lines from the cool secondary of HR 5110 have been detected on 16 spectra with resolution 0.3 A. New mass and light ratios have been determined. Effective temperature of 6750 K and 4700 K for the primary and secondary respectively have been estimated from the line spectrum. The extremely weak H alpha absorption profile of HR 5110 revealed an emission profile after a comparison composite spectrum was subtracted. The strong, variable, residual H alpha emission has two components: a narrow and steady emission peak and a variable and extremely broad component. A simple model with Stark broadening in a dense chromosphere of the K star can explain the broad component, while the narrow peak appears to come from an accretion disk around the primary. Dissert. Abstr.

N87-11658 Princeton Univ., N. J.
PHOTOMETRIC REDSHIFTS AND COSMOLOGY Ph.D. Thesis
Earl Joseph Spillar 1985 103 p
Avail: Univ. Microfilms Order No. DA8607712

How to obtain redshifts of galaxies from photometry through medium width filters is demonstrated. By exploiting the efficiency and red response of a Charge Coupled Device one is able to obtain redshifts for hundreds of faint galaxies in a few hours, which is a considerable speed improvement over spectrographic methods. The sizes of the errors in the redshifts are predictable and are smaller then 0.08 in z. The redshift data is applied to the question of galactic evolution. Comparing the luminosity distribution of galaxies in the sample with that of nearby galaxies it is concluded that galaxies have grown fainter by 0.5 + or - 0.2 mag in the visual band since the epoch of z = 0.55. The ratio of red galaxies to blue galaxies has decreased by 10 + or - 20%. We review the current theoretical understanding of galactic evolution and find our data consistent with it. If evolution does not change the number of galaxies in an undecipherable way, the number per volume fixes the amount of volume at different redshifts. Knowledge of the volume allows the determination of the cosmological deceleration parameter q sub zero. The difficulties in using photometric redshifts to understand the effects of evolution and determine q sub zero are outlined. Dissert. Abstr.

N87-11659 Texas Univ., Austin.
MOLECULAR CLOUDS ASSOCIATED WITH YOUNG OPEN STAR CLUSTERS Ph.D. Thesis
David Todd Leisawitz 1985 407 p
Avail: Univ. Microfilms Order No. DA8609534

Regions around 69 open star clusters were searched for spectral line emission. Of these, 47 regions were completely or nearly completely mapped with a sampling interval of 7.5 arcminutes. The region surveyed around each cluster was at least 10 cluster diameters in size, typically approx. 3 square degrees. The physical characteristics and the kinematics of the ensemble of molecular clouds associated with the clusters are examined. This enables empirical determination of the systematic interaction between young star clusters and the interstellar matter from which they form. Molecular clouds associated with clusters whose ages are less than 5 million years are expanding away from those clusters at approximately 10 km/s, thus explaining the relative paucity of emission detected in the neighborhoods of older clusters. Evidence is found that the clouds, to some extent, dissolve in the stellar radiation field. Results of the survey are consistent with a picture in which molecular cloud complexes are disrupted by a cluster-centered energy source within only approx. 5 Myr of the time massive cluster stars reach the main sequence. Stellar winds probably are sufficciently energetic to explain the observations. Dissert. Abstr.

N87-11660 California Univ., Berkeley.
DEVELOPMENT OF A CCD CAMERA FOR AN AUTOMATED SUPERNOVA SEARCH AND OBSERVATIONS OF A SUPERNOVA IN NGC 5033 Ph.D. Thesis
Michael Shane Burns 1985 71 p
Avail: Univ. Microfilms Order No. DA8609959

The Berkeley supernova search uses an automated telescope along with a Charge Coupled Device (CCD) camera and a dedicated minicomputer to automatically scan galaxies for supernova. The system is currently able to observe about 500 galaxies in a full night of observing. These images are stored on video tapes which are brought back to the lab the next day for analysis. This paper begins with a brief summary of our observational and theoretical understanding of supernova. The design of the search system is discussed with an emphasis on its current operation. The development and performance of the CCD camera is described in detail as well as the performance of the entire system. Finally, observations of a supernova in NGC 5033 are presented. Dissert. Abstr.

N87-11054*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Space Physics and Astrophysics Section.
OBJECTIVES AND FIRST RESULTS OF THE NASA SETI SKY SURVEY FIELD TESTS AT GOLDSTONE
S. Gulkis, M. J. Klein, E. T. Olsen, R. B. Crow, R. M. Gosline, G. S. Downs, M. P. Quirk, A. Lokshin, and J. Solomon *In its* The Telecommunications and Data Acquisition Report (date) p 284 - 300 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N87-11661 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
TORQUE AND ENERGY EXCHANGE BETWEEN AN ACCRETION DISK AND A RAPIDLY SPINNING NEUTRON STAR
W. Priedhorsky Jan. 1985 18 p Submitted for publication Sponsored in part by DOE
(MPE-Preprint-44; ISSN-0178-0719; ETN-86-98263) Copyright. Avail: Issuing Activity

Torque-coupled energy flows are proposed to explain the bimodal behavior of the quasi-periodic oscillations, spectrum, radio outbursts, and optical flux in Sco X-1. Accretion torques move energy in or out a flywheel (stored rotational energy). The material torque from accreting matter reduces the luminosity available at the neutron star surface, thought to be the source of the blackbody component of low-mass X-ray binary spectra. In equilibrium, the material spinup torque must be balanced by a spindown torque against the disk or expelled matter. In spindown work is dissipated in the disk, it becomes brighter. This explains the large excesses of disk over blackbody flux. The disk flux changes only gradually with accretion rate, while the neutron star surface flux increases rapidly, as for the two-component spectral behavior observed in low-mass X-ray binaries. For lower accretion rates, the spindown luminosity of the neutron star dominates, and total luminosity increases with decreasing mass accretion rate. ESA

N87-11662* Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
BIMODAL QUASI-OSCILLATORY AND SPECTRAL BEHAVIOR IN SCO X-1
W. Priedhorsky, G. Hasinger, W. H. G. Lewin, J. Middleditch, A. Parmar, L. Stella, and N. White Jan. 1985 18 p Submitted for publication Sponsored in part by NASA, Alexander von Humboldt St8iftung, John Simon Guggenheim Memorial Foundation, and by DOE
(MPE-Preprint-45; ISSN-0178-0719; ETN-86-98264) Copyright. Avail: Issuing Activity

X-ray observations were made to follow up the discovery of quasi-periodic oscillations (QPO) in Sco X-1. The QPO is observed in the quiescent state, and between flares in the active state. When the source is quiescent, the QPO frequency is 6 Hz and anticorrelated with intensity; in the active state, the frequency ranges from 10 to 20 Hz and is strongly correlated with intensity. At high intensities the QPO dissolves into continuum noise. The QPO rms amplitude decreases with count rate, and increases with photon energy. There are two modes of spectral behavior, with a one-to-one correspondence to the two modes of QPO: the spectral hardness ratio varies more steeply with intensity when the source shows 6 Hz QPO, than for 10 to 20 Hz QPO. Transitions between QPO modes, which occur when the flux is at its lowest levels, correspond to transitions between hardness ratio modes. The QPO frequency changes continuously through the transitions, which last a few hundred seconds. ESA

N87-11663# Fermi National Accelerator Lab., Batavia, Ill.
NEUTRINOS FROM GRAVITATIONAL COLLAPSE
R. Mayle, J. R. Wilson, and D. N. Schramm May 1986 36 p
(Contract DE-AC02-76CH-03000)
(DE86-012304; FNAL/Pub-86/81-A) Avail: NTIS HC A03/MF A01

Detailed calculations are made of the neutrino spectra emitted during gravitational collapse events (Type II supernovae). Those aspects of the neutrino signal which are relatively independent of the collapse model and those aspects which are sensitive to model details are discussed. The easier-to-detect high energy tail of the emitted neutrinos has been calculated using the Boltzmann equation which is compared with the result of the traditional multi-group flux limited diffusion calculations. DOE

N87-11664# Rome Univ. (Italy). Dipt. di Fisica.
ON THE RADIATION EMITTED BY A PARTICLE FALLING INTO A BLACK HOLE IN THE SEMIRELATIVISTIC APPROXIMATION
C. Coretti and V. Ferrari 10 Dec. 1985 25 p
(Nota-Interna-857; ETN-86-97891) Avail: NTIS HC A02/MF A01

The semirelativistic approximation is used to compute the electromagnetic energy emitted when a charged particle falls into a Reissner-Nordstrom black hole. Results are compared with those obtained by integrating numerically the perturbed Maxwell equations in the case of radial fall. The semirelativistic approximation method requires much less computer time, because part of the calculations can be done analytically, and it can be applied to any given geodesic followed by the particle. It is shown that in the case of spherically symmetric black holes the approximate method gives realistic results: it predicts the correct behavior of the radiation versus the angular momentum of the particle and the correct order of magnitude of the amount of energy emitted. When the method is applied to rotating black holes the use of the Boyer-Lindquist coordinates is forbidden by the effects of the infinite rotation of the particle when it approaches the radius of the horizon. It is shown that different choices of the coordinate systems give different results. ESA

N87-11665 California Inst. of Tech., Pasadena.
ON THE CHEMICAL COMPOSITION OF INTERSTELLAR MOLECULAR CLOUDS: A MILLIMETER AND SUBMILLIMETER SPECTRAL LINE SURVEY OF OMC-1 Ph.D. Thesis
Geoffrey A. Blake 1986 318 p
Avail: Univ. Microfilms Order No. DA8605395

Results from a millimeter and submillimeter spectral line survey of the core of the Orion molecular cloud (OMC-1) are presented. The millimeter-wave survey, conducted at the Owens Valley Radio Observatory (OVRO), covers a 55 GHz interval in the 1.3 mm (23 GHz) atmospheric window and contains emission from 29 molecules. Together with the frequency selective submillimeter observations of H2D(+) (372.4 GHz), Cl (492.2 GHz), NH3 (572.5 GHz), and HCl (625.9 GHz) performed from the NASA Kuiper Airborne Observatory, over 800 emission lines have been detected from 33 chemically distinct species during the course of this work. The uniformly calibrated results from the unique and extensive OVRO spectral line survey place significant constraints on models of interstellar chemistry, and have allowed the chemical composition of the various regions in OMC-1 to be definitively characterized. A global analysis of the observed abundances has shown that the markedly different chemical compositions of the kinematically distinct Orion subsources may be simply interpreted in the framework of an evolving, initially quiescent, gas phase chemistry influenced by the process of massive star formation. The chemical composition of the extended Orion cloud complex is similar to that found in a number of other objects, but the central regions of OMC-1 have had their chemistry selectively altered by the high velocity outflow from the young star(s) embedded within the interior of the molecular cloud. Dissert. Abstr.

N87-11666 California Univ., Los Angeles.
TYPES AND PROPERTIES OF PLANETARY TORI AND LIMIT ON MASS LOSS FROM SATELLITES Ph.D. Thesis
Tian-Sen Huang 1986 160 p
Avail: Univ. Microfilms Order No. DA8606460

The main objects of this dissertation are to investigate the general equilibrium state properties of planetary tori including the particle number budget and the stabilities, and to study the effects of magnetic field line breaking and corotation lag in large mass injection rate on the properties of planetary tori. A general model for the global balance of neutrals and ions composing planetary plasma tori is proposed. A classification of tori based on neutral source processes and ion loss processes is presented. The equilibrium and stability properties of each type are discussed. The effects of the current sheet on the ion density distribution of the Io torus and the magnetic field of the Jovian magnetosphere are examined. The torus ion density and magnetic field distributions for different plasma transport fluxes are given. By means of the balance between magnetic energy density and corotation energy

density we determine a magnetic field breaking distance. For the present Io torus this distance is 18 times Jovian radii. As the ion transport increases it moves inward, and a maximum limit on plasma transport rate is obtained. A unified torus model is built and the effects of the corotation lags on the properties of the Io H2O torus are considered. Dissert. Abstr.

N87-11667 Indiana Univ., Bloomington.
THE INTERACTION OF A STRONG STELLAR WIND WITH A MULTIPHASE INTERSTELLAR MEDIUM Ph.D. Thesis
Michael Thomas Wolff 1986 353 p
Avail: Univ. Microfilms Order No. DA8607450

The interaction of a strong stellar wind with the interstellar medium produces a hot, low density cavity surrounded by a swept-up shell of gas. This cavity-plus-shell structure is collectively called an interstellar bubble. In calculations prior to this work, researchers assumed that the interstellar medium surrounding the wind-blowing star was described by a constant density and temperature (i.e., was homogeneous). These earlier calculations are improved on by assuming that the interstellar medium surrounding the star is inhomogeneous, or multiphase. These gas flows are modeled by assuming that the inhomogeneous phases of the interstellar medium (the clouds) and the intercloud gas form two distinct but interacting fluids that can exchange mass, momentum and energy with each other. The mass injection from the clouds to the intercloud gas found via the process of thermal evaporation can significantly modify the structure of the interstellar bubble from that found in previous studies. Real early-type wind blowing stars generally have a large luminosity of Lyman continuum photons that can evaporated cold clouds. Two bubble models including this photoevaporation were computed. In an interstellar medium with cold clouds embedded in a hot, low density intercloud gas, the photoevaporation of cold gas causes a dense shell to form that has an observable emission measure. Dissert. Abstr.

N87-11668 Texas Univ., Austin.
VACUUM POLARIZATION ON BLACK HOLE SPACETIMES Ph.D. Thesis
Bruce Philip Jensen 1985 81 p
Avail: Univ. Microfilms Order No. DA8609520

The effects of vacuum polarization in black hole spacetimes are examined. Particular attention is given to the vacuum physics inside the event horizon. The analytic properties of the solutions to the radial wave equation in Schwarzschild spacetime as functions of argument, frequency, and angular momentum are given. These functions are employed to define the Feynmann Green function for a scalar field subject to the Hartle-Hawking boundary conditions. An examination of the Schwarzschild mode functions near r = O is provided. This work is necessary background for a future calculation of (phi sq) and the quantum stress-energy tensor (T sub mu sup upsilon) for small r. Some opinions are given on how this calculation might be performed. A solution of the one-loop Einstein equations for Schwarzschild Anti-deSitter (SAdS) space-time is presented, using Page's approximation to the quantum stress tensor. The resulting perturbed metric is shown to be unphysical, as it leads to a system of fields with infinite total energy. This problem is believed to be due to a failure of Page's method in SAdS. Suggestions are given on how one might correct the method. Dissert. Abstr.

N87-11669 Maryland Univ., College Park.
QUANTUM EFFECTS IN NON-MAXIMALLY SYMMETRIC SPACES Ph.D. Thesis
Tsung-Cheng Shen 1985 155 p
Avail: Univ. Microfilms Order No. DA8614287

Non-maximally symmetric spaces provide a more general background to explore the relation between the geometry of the manifold and the quantum fields defined in the manifold than those with maximally symmetric spaces. A static Taub universe is used to study the effect of curvature anisotropy on the spontaneous symmetry breaking of a self-interacting scalar field. The one-loop effective potential of lambda phi to the 4th power field with arbitrary coupling Xi is computed by zeta function regularization. We find that for massless minimal coupled scalar field, first order phase transition can occur. Keeping the shape invariant but decreasing the curvature radius of the universe induces symmetry breaking. If the curvature radius is held constant, increasing deformation can restore the symmetry. Studies on the higher-dimensional Kaluza-Klein theories are also focused on the deformation effect. Using the dimensional regularization, the effective potential of the free scalar fields in M sup 4 x T sup n and M sup 4 x (taub) to the 3rd power spaces are obtained. The stability criterions for the static solutions of the self-consistent Einstein equations are derived. We find the stablesolutions of the M sup 4 x S sup N topology do not exist. With the Taub space as the internal space, the gauge coupling constants of SU(2), and U(1) can be determined geometrically. The weak angle is therefore predicted by geometry in this model. Dissert. Abstr.

N87-11053*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Navigation Systems Section.
ICE NAVIGATION SUPPORT
L. Efron, R. J. Muellerschoen, and R. I. Premkumar *In its* The Telecommunications and Data Acquisition Report (date] p 268 - 283 (For primary document see N87-11024 02-32)
Avail: NTIS HC A14/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N87-11670*# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
HIGH PRESSURE COSMOCHEMISTRY APPLIED TO MAJOR PLANETARY INTERIORS: EXPERIMENTAL STUDIES Status Report
Malcolm F. Nicol, Steven Boone, and Huyn-chae Cynn 1 Nov. 1986 4 p
(Grant NAGw-104)
(NASA-CR-177188; NAS 1.26:177188) Avail: NTIS HC A02/MF A01 CSCL 03B

The overall goal of this project is to determine properties of the H-He-C-N-O system, as represented by small molecules composed of these elements, that are needed to constrain theoretical models of the interiors of the major planets. Much of our work now concerns the H2O-NH3 system. This project is the first major effort to measure phase equilibria in binary fluid-solid systems in diamond anvil cells. Vibrational spectroscopy, direct visual observations, and X-ray crystallography of materials confined in externally heated cells are our primary experimental probes. We also are collaborating with the shockwave physics group at Lawrence Livermore Laboratory in studies of the equation of state of a synthetic Uranus fluid and molecular composition of this and other H-C-N-O materials under planetary conditions. Author

N87-11671*# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
THE AMMONIA-WATER PHASE DIAGRAM AND ITS IMPLICATIONS FOR ICY SATELLITES
Mary L. Johnson and Malcolm Nicol 1986 53 p
(Grant NAGw-104)
(NASA-CR-179881; NAS 1.26:179881) Avail: NTIS HC A04/MF A01 CSCL 03B

A Holzapfel-type diamond anvil cell is used to determine the NH3 - H2O phase diagram in the region from 0 to 33 mole percent NH3, 240 to 370 K, and 0 to 5 GPa. The following phases were identified: liquid; water ices Ih, III, V, VI, VII, and VIII; ammonia monohydrate, NH3.H2O; and ammonia dihydrate NH3.2H2O. Ammonia dihydrate becomes prominent at moderate pressures (less than 1 GPa), with planetologically significant implications, including the possibility of layering in Titan's magma ocean.Author

N87-11672*# California Inst. of Tech., Pasadena.
STUDIES OF THE COMPOSITION OF SOLAR PARTICLES AND OF ENERGETIC OXYGEN AND SULFUR NUCLEI TRAPPED IN THE JOVIAN MAGNETOSPHERE Final Report, 15 May 1981 - 15 May 1984
E. C. Stone 7 Nov. 1986 17 p
(Grant NAGw-200)
(NASA-CR-179863; NAS 1.26:179863) Avail: NTIS HC A02/MF A01 CSCL 03B

The Cosmic Ray System (CRS) experiment on board each of the Voyager 1 and 2 spacecraft consists of four Low Energy Telescopes (LETs), two High Energy Telescopes (HETs), the Electron Telescope (TET), and associated electronics. With these instruments it is possible to measure the energy spectrum of electrons over the 3-110MeV energy range and the energy spectra and nuclear charge of atomic nuclei from hydrogen through zinc over the 3-500 MeV/nuc energy range. The exclusive use of solid-state detectors in the CRS telescopes achieves the objectives of reliability over a long mission life, high resolution determinations of energy and charge, and high-count-rate capability during large solar flares and passage through the magnetospheres of the outer planets. Summarized here are some of the many accomplishments that have resulted from the CRS measurements during the period covered by this report, May 15, 1981 to May 15, 1984, including studies of the energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere. Author

N87-11673*# New York Univ., New York. Dept. of Applied Science.
THE MARTIAN CLIMATE AND ENERGY BALANCE MODELS WITH CO2/H2O ATMOSPHERES Final Report, 1 Mar. 1984 - 31 Mar. 1986
Martin I. Hoffert 31 Mar. 1986 37 p Submitted for publication
(Grant NAGw-573)
(NASA-CR-179888; NAS 1.26:179888) Avail: NTIS HC A03/MF A01 CSCL 03B

The analysis begins with a seasonal energy balance model (EBM) for Mars. This is used to compute surface temperature versus x = sin(latitude) and time over the seasonal cycle. The core model also computes the evolving boundaries of the CO2 icecaps, net sublimational/condensation rates, and the resulting seasonal pressure wave. Model results are compared with surface temperature and pressure history data at Viking lander sites, indicating fairly good agreement when meridional heat transport is represented by a thermal diffusion coefficient D approx. 0.015 W/sq. m/K. Condensational wind distributions are also computed. An analytic model of Martian wind circulation is then proposed, as an extension of the EMB, which incorporates vertical wind profiles containing an x-dependent function evaluated by substitution in the equation defining the diffusion coefficient. This leads to a parameterization of D(x) and of the meridional circulation which recovers the high surface winds predicted by dynamic Mars atmosphere models (approx. 10 m/sec). Peak diffusion coefficients, D approx. 0.6 w/sq m/K, are found over strong Hadley zones - some 40 times larger than those of high-latitude baroclinic eddies. When the wind parameterization is used to find streamline patterns over Martian seasons, the resulting picture shows overturning hemispheric Hadley cells crossing the equator during solstices, and attaining peak intensities during the south summer dust storm season, while condensational winds are most important near the polar caps. Author

N87-11674# Los Alamos National Lab., N. Mex.
RESONANCE CAPTURE AND SATURN'S RINGS
C. W. Patterson May 1986 12 p
(Contract W-7405-eng-36)
(DE86-011733; LA-10727-MS) Avail: NTIS HC A02/MF A01

We have assigned the resonances apparently responsible for the stabilization of the Saturn's shepherd satellites and for the substructure seen in the F-ring and the ringlets in the C-ring. We show that Saturn's narrow ringlets have a substructure determined by three-body resonances with Saturn's ringmoons and the sun. We believe such resonances have important implications to satellite formation. DOE

N87-11675 Florida Univ., Gainesville.
JUPITER'S DECAMETER AND KILOMETER EMISSIONS: SATELLITE EFFECTS AND LONG TERM PERIODICITIES Ph.D. Thesis
Orville Chris St.Cyr 1985 193 p
Avail: Univ. Microfilms Order No. DA8615506

The results of observational studies of Jupiter's decameter (DAM) and kilometer (KOM) radio emissions are presented. The initial goal was to investigate the role of Jupiter's major satellites in modulating these sporadic emissions. The concepts of electromagnetic induction are reviewed in planet-sized bodies and then the Jovian magnetosphere environment and the physical characteristics of the Galilean satellites and Amalthea are described. Since the phase of Io is known to modulate the DAM emission, the problem of orbital resonance among the Galilean satellites is addressed. A secondary goal was to search for long term periodicities and other effects in the groundbased DAM data. Dissert. Abstr.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N87-11676*# Alabama Univ., Huntsville. Dept. of Physics.
INTERNATIONAL SOLAR-TERRESTRIAL PROGRAM DATA PROCESSING CONSORTIUM Final Report
Roy B. Torbert 3 Sep. 1986 11 p
(NASA Order H-78750B)
(NASA-CR-178919; NAS 1.26:178919; UAH-530) Avail: NTIS HC A02/MF A01 CSCL 03B

The present conception of the data processing scheme is described including the Main Processing Units (MPU) and Satellite Processing Units (SPU) which will acquire the data for the instruments presently planned in the International Solar Terrestrial Physics (ISTP) Project. B.G.

N87-11677# Stanford Univ., Calif. Center for Space Science and Astrophysics.
AN ATLAS OF PHOTOSPHERIC MAGNETIC FIELD OBSERVATIONS AND COMPUTED CORONAL MAGNETIC FIELDS, 1976-1985
J. Todd Hoeksema and Philip H. Scherrer 1986 13 p
(Contracts N00014-86-K-0085; N00014-76-C-0207)
(AD-A168046) Avail: NTIS HC A02/MF A01 CSCL 03/2

Daily magnetogram observations of the large scale photospheric magnetic field have been made. These measurements provide a homogeneous record of the changing solar field through most of Solar Cycle 21. Using the photospheric data, the configuration of the coronal and heliospheric fields can be calculated using a Potential Field -- Source Surface model. This provides a 3 dimensional picture of the heliospheric field evolution during the solar cycle. This note announces the publication of UAG Report 94, an Atlas containing the complete set of synoptic charts of the measured photospheric magnetic field, the computed field at the source surface, and the coefficients of the multipole expansion of the coronal field. The general underlying structures of the solar and heliospheric fields, which determine the environment for solar terrestrial relations and provide the context within which solar activity related events occur, can be approximated from these data. The provision of a homogeneous dataset of the solar magnetic field over nearly an entire sunspot cycle in a convenient, inclusive package will stimulate the studies of the large scale structures of the solar and heliospheric magnetic field, encourage others to consider the relationship of the large scale, ambient field structures to activity on short time scales and smaller spatial scales, and

enable the inclusion of the heliospheric field in analyses of solar terrestrial relations. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N87-11678 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
X-RAY BURSTS FROM GX 17+2: A NEW APPROACH
M. Sztajno, J. vanParadijs, W. H. G. Lewin, A. Langmeier, J. Truemper, and W. Pietsch Mar. 1986 28 p Submitted for publication Sponsored by Alexander von Humboldt Foundation, and John Simon Guggenheim Memorial Foundation
(MPE-Preprint-48; ETN-86-98209) Copyright. Avail: Issuing Activity

A short (10 sec) and long (5 min) X-ray burst from GX 17+2, of maximum intensity 40% above persistent flux level, were detected. A time dependent spectral analysis of the long burst provides a consistent description of the intensity and spectral variations during the burst in terms of the luminosity (and temperature) variation of a hot blackbody (or blackbody-like) emitter. Outside the burst the blackbody component contributes 40% to the persistent emission. This result resolves ambiguity in the classification of bursts from GX 17+2 as type 1 or type 2, and indicates that, in spite of the absence of a distinct softening of the net burst emission, the bursts are due to thermonuclear flashes. ESA

N87-11679 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
SEARCH FOR ORBITAL X-RAY VARIATION IN SCO X-1
W. Priedhorsky and Steve Holt Apr. 1986 18 p Submitted for publication
(MPE-Preprint-51; ETN-86-98211) Copyright. Avail: Issuing Activity

All 5 yrs of 3 to 6 keV monitoring of Sco X-1 by the Ariel 5 all-sky monitor were reanalyzed, to search more sensitively for variation at the 0.787313 day orbital period. The best limits on orbital variations come from data selected to exclude active episodes. Any narrow absorption dip has an average depth < 1.0% 0.1/Delta Phi - (2 sigma) where Delta Phi is the dip width in units of the orbital period. A weak (0.4%) sinusoidal modulation, with 3.2 sigma significance, reaching minimum at phase 0.59 + or - 0.06 with respect to superior conjunction of the optical emission line source is observed. The upper limit to a sinusoidal orbital modulation is 0.7%. Sco X-1 never (at least not for more than 2 hr) dips below its normal quiescent level. ESA

N87-11680* Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DISAPPEARANCE OF PERIODIC X-RAY MINIMA IN AM HER
W. Priedhorsky, F. J. Marshall, and D. R. Hearn Apr. 1986 22 p Submitted for publication Sponsored in part by DOE
(Contract NAS5-24441)
(MPE-Preprint-52; ETN-86-98212) Copyright. Avail: Issuing Activity

Optical, soft X-ray, and medium energy X-ray measurements taken during an unusual high state of AM Her are reported. The X-ray and secondary optical minima disappeared from the light curve. The X-ray flux varied periodically. In each X-ray band, the flux during the expected phase of minimum was approximately the same as the average during the rest of the cycle. The optical and medium energy X-ray fluxes were at all-time highs; however, the soft X-ray flux was low by a factor of 3 compared to the nominal high state. This change in the ratio of medium to soft X-ray flux is difficult to fit into the standard scenario for AM Her, where soft X-rays are interpreted as reprocessed optical and medium energy X-ray flux. The peculiar light curve of AM Her was probably caused by a small shift in the position of the accretion column with respect to the rotation axis, so that the normal grazing eclipse of the accretion column did not take place. ESA

N87-11681# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
A SPACE RADIATION TEST MODEL STUDY Report, 20 May 1985 - 20 Feb. 1986
R. W. Nightingale, Y. T. Chiu, G. T. Davidson, W. E. Francis, and M. A. Rinaldi 14 Mar. 1986 55 p
(Contract F19628-85-C-0073)
(AD-A169412; LMSC/F134561; LMSC/F146531;
AFGL-TR-86-0064) Avail: NTIS HC A04/MF A01 CSCL 04/1

Dynamic models of the energetic populations in the outer radiation belts are being developed to better understand the extreme variations of particle flux in response to magnetospheric and solar activity. The study utilizes the SCATHA SC3 high energy electron data, covering energies from 47 keV to 5 MeV with fine pitch angle measurements (3 deg field of view) over the L-shell range of 5.3 to 8.7. Butter-fly distributions in the dusk sector signify particle losses due to L shell splitting of the particle drift orbits and the subsequent scattering of the particles from the orbits by the magnetopause. To model the temporal variations and diffusion procsses of the particle populations, the data have been organized into phase space distributions, binned according to altitude (L shell), energy, pitch angle, and time. These distributions can then be mapped to the equator and plotted for fixed first and second adiabatic invariants of the inherent particle motion. A new and efficient method for calculating the third adiabatic invariant using a line integral of the relevant magnetic potential a t the particle mirror points has been developed and is undergoing testing. This method will provide a useful means of displaying the radial diffusion signatures of the outer radiation belts during the more active periods when the L shell parameter is not a good concept due to severe drift-shell splitting. The first phase of fitting the energetic electron phase-space distributions with a combined radial and pitch-angle diffusion formulation is underway. GRA

N87-11682# Rome Univ. (Italy). Dipt. di Fisica.
SCALING VIOLATION IN HADRONIC INTERACTIONS AND THE DEEP UNDERGROUND FLUX OF COSMIC MUONS
G. Auriemma and E. Berardi 10 Jan. 1986 7 p Submitted for publication
(Preprint-495; ETN-86-97928) Avail: NTIS HC A02/MF A01

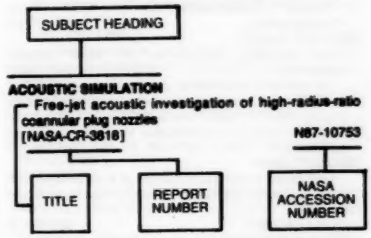
The spectrum of high energy muons is derived from experimental data in the 200 to 2000 GeV range under the hypothesis that the violation of scaling observed in the central rapidity region, extends also to the fragmentation region. Analytical treatment of the process of muon production in the atmosphere suggests that the violation of scaling gives a logarithmic increase of the underground flux of muons at high energies, with respect to the predictions of the scaling. The amount of this deviation is expected to be small. ESA

99 GENERAL

N87-11683# National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT
1984 148 p
Avail: NTIS HC A07/MF A01

The achievements for the United States aeronautics and space programs for the year 1984 are summarized. The achievements are presented according to sponsoring agency. B.G.

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7053).

A

ABLATION
Single-pulse laser effects measurements at 248 nm
[DE86-011229] N87-11157
ABSORPTION SPECTROSCOPY
Spectral study of rocks and some iron deposits from Eastern China N87-11308
ABSTRACTS
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572
ABUNDANCE
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651
ACCELERATED LIFE TESTS
Aerospace nickel-cadmium cell separator qualifications program N87-11085
ACCIDENTS
Dispersion of accidentally released heavy gases — wind tunnel tests N87-11432
ACCRETION DISKS
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661
ACCURACY
Accuracy analysis of satellite experiments for the measurement of the radiation budget N87-11379
ACID RAIN
Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353
Thermodynamic aspects of the absorption of gas in droplets N87-11421
ACOUSTIC EXCITATION
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908
Spacecraft structural acoustics: Progress in vibration level prediction N87-10943
ACOUSTIC IMPEDANCE
Sound propagation over uneven ground and irregular topography
[NASA-CR-179827] N87-11575
ACOUSTIC MEASUREMENT
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179832] N87-11123
Using acoustic waves for the characterization of closed fatigue cracks
[DE86-011404] N87-11228
ACOUSTIC VELOCITY
Determination of the mass concentration of the particles in aerosols using the sound velocity measurement
[FR-235/20-1] N87-11574
ACTIVE CONTROL
On optimal passive and active control of precision spacecraft structures N87-10891
ADAPTIVE CONTROL
Design of control laws for adaptive signal tracking systems N87-10882
Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597
ADAPTIVE OPTICS
Optical filtering techniques
[AD-A168084] N87-11596
ADHESION
The interface between fiber and matrix resin from a chemical point of view N87-10970
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621
ADHESION TESTS
Non-destructive methods of characterising the strength of adhesive-bonded joints
[RAE-TM-MAT/STR-1065] N87-11176
ADHESIVE BONDING
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
Non-destructive methods of characterising the strength of adhesive-bonded joints
[RAE-TM-MAT/STR-1065] N87-11176
Measurement of stress distributions in adhesive bonded joints
[AD-A169178] N87-11227
ADHESIVES
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010
ADIABATIC DEMAGNETIZATION COOLING
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
ADVECTION
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384
AERIAL PHOTOGRAPHY
Anemothermographic remote sensing using airborne sensors: A new method of micrometeorological cartography N87-11291
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
Estimation of atmospheric corrections from multiple aircraft imagery N87-11306
Remote sensing in hydrology — aerial photography
[ICW-1687] N87-11340
AERODYNAMIC BALANCE
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis
[NASA-CR-3608] N87-10836
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg
[NASA-CR-3747] N87-10837
Piloted simulation study of the effects of an automated trim system on flight characteristics of a light twin-engine airplane with one engine inoperative
[NASA-TP-2633] N87-10843
AERODYNAMIC CHARACTERISTICS
Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842
AERODYNAMIC COEFFICIENTS
Report on tests of a CAST 10 airfoil with fixed transition in the T2 transonic cryogenic wind tunnel with self-adaptive walls
[RT-OA-63/1685] N87-10834
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle
[NASA-TM-85758] N87-10869
Flight-determined aerodynamic derivatives of the AD-1 oblique-wing research airplane
[NASA-TP-2222] N87-10871
AERODYNAMIC CONFIGURATIONS
Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842
AERODYNAMIC DRAG
Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end
[NASA-TP-2352] N87-10838
AERODYNAMIC HEATING
A bibliography of aerodynamic heating references
[BAE-BT-13481] N87-10832
AERODYNAMIC INTERFERENCE
Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90
[NASA-TP-2350] N87-10870
AERODYNAMIC LOADS
Unsteady airload computations for airfoils oscillating in attached and separated compressible flow
[NLR-MP-85040-U] N87-10848
AERODYNAMIC NOISE
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172494] N87-10859
Propeller aircraft interior noise model utilization study and validation
[NASA-CR-172428] N87-11576
AERODYNAMIC STABILITY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation
[NASA-TP-2375] N87-10841
AEROELASTICITY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
AEROLOGY
Boundary layer investigations and aerological measurements at the Antarctic research station Georg von Neumayer N87-11442
AERONAUTICAL ENGINEERING
Graduate engineering research participation in aeronautics
[NASA-CR-179798] N87-10828
AEROSOLS
Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983
[NASA-RP-1172] N87-11358
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns
[ESA-CR(P)-2254] N87-11363
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370
Data bases for isolating the effects of the increasing carbon dioxide concentration
[DE86-009709] N87-11469

Determination of the mass concentration of the particles in aerosols using the sound velocity measurement
[FR-235/20-1] N87-11574

AEROSPACE ENGINEERING
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643

AEROSPACE ENVIRONMENTS
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010
Impact of shuttle environment on prelaunch handling of nickel-hydrogen batteries N87-11099
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507

AEROSPACE MEDICINE
USSR Space Life Sciences Digest, issue 8
[NASA-CR-3922(09)] N87-11478
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481

AEROSPACE SYSTEMS
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645

AEROSPACE VEHICLES
Model designation of military aerospace vehicles
[PB86-222429] N87-10831

AEROTHERMODYNAMICS
A bibliography of aerodynamic heating references
[BAE-BT-13481] N87-10832
Hot turbine heat transfer overview N87-11184
Aerothermal modeling program, phase 2 N87-11200

AGE FACTOR
Laboratory measurements of spectral reflectance (0.4 to 2.3 micron) of basalts N87-11332

AGING (MATERIALS)
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179833] N87-11142

AIR
Effective conductivity of aging polyurethane foam
[DE86-006939] N87-11011
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606

AIR FLOW
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458

AIR POLLUTION
Remote sensing methods to determine the vitality of vegetation
[LITERATUUROVERZICHT-42] N87-11235
Dry deposition parameterization in long range transport models — pollution transport
[KNMI-WR-86-1] N87-11354
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370
A statistical method for prediction of pollutant emission N87-11428
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430
Dispersion of accidentally released heavy gases — wind tunnel tests N87-11432
Increase of the dust mass content in the air of Hamburg (West Germany) N87-11450

AIR TRAFFIC CONTROL
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10854
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864

AIR WATER INTERACTIONS
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244
Analysis of airborne measurements of the marine boundary layer during the TOSCANE experiment — scatterometry N87-11250
Wind tunnel investigation of the characterization of radar backscattering by different wave fields — sea waves N87-11261
Climate-effective transport processes in the ocean N87-11380
Interactive coupling of oceanic top layer models and atmospheric circulation models N87-11399
Coupled ocean-atmosphere models without drift of the prognostic variables N87-11402
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423
Measurements in the ground level atmospheric layer during the experiment PUKK — wind, temperature, and moisture profiles N87-11449
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453

AIRBORNE EQUIPMENT
Minimum operational performance standards for airborne ILS glide slope receiving equipment operating within the radio frequency range of 328.6-335.4 MHz
[RTCA/DO-192] N87-10853
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
Reflectance properties of conifers, measured from a helicopter N87-11321
Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983
[NASA-RP-1172] N87-11358

AIRBORNE/SPACEBORNE COMPUTERS
Digital data recording on floppy disks applied for on-board use in helicopters
[DFVLR-MITT-86-10] N87-11149
High speed programmable processor for use on board satellites
[EPT/DI/006/GG/TT] N87-11497
A summary of DO-178A — airborne software certification
[PNR-90294] N87-11518

AIRCRAFT ACCIDENTS
National Transportation Safety Board safety recommendation N87-10852

AIRCRAFT COMPARTMENTS
An experimental investigation of the interior noise control effects of propeller synchrophasing
[NASA-CR-178185] N87-11577

AIRCRAFT CONFIGURATIONS
Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end
[NASA-TP-2352] N87-10838

AIRCRAFT CONSTRUCTION MATERIALS
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials
[DFVLR-FB-86-16] N87-11003

AIRCRAFT CONTROL
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis
[NASA-CR-3608] N87-10836
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg
[NASA-CR-3747] N87-10837

AIRCRAFT DESIGN
Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643

AIRCRAFT ENGINES
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90296] N87-10867
Engine performance monitoring for airlines
[PNR-90305] N87-10868
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180

AIRCRAFT FUELS
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014

AIRCRAFT GUIDANCE
Energy management of 3-dimensional minimum-time intercept N87-10858

AIRCRAFT HAZARDS
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985

AIRCRAFT NOISE
An experimental investigation of the interior noise control effects of propeller synchrophasing
[NASA-CR-178185] N87-11577
Aircraft noise measurement: The 1.2 metre microphone height saga
[PNR-90315] N87-11578

AIRCRAFT PRODUCTION COSTS
Net shape forming: The route to low cost components. The view point of the aerospace industry
[PNR-90306] N87-11020

AIRCRAFT RELIABILITY
National Transportation Safety Board safety recommendation N87-10852

AIRCRAFT SAFETY
Ice accretion dependence on cloud physical parameters N87-11433
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
The influence of weather-active fronts on visual flight conditions N87-11437

AIRCRAFT SPIN
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis
[NASA-CR-3608] N87-10836

AIRCRAFT STRUCTURES
Critical joints in large composite aircraft structure
[NASA-CR-3710] N87-10973
DC-10 composite vertical stabilizer ground test program
[NASA-CR-3715] N87-10974
Critical composite joint subcomponents: Analysis and test results
[NASA-CR-3711] N87-10975
Corrosion and corrosion prevention in aircraft structures
[NLR-MP-85029-U] N87-11004
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579

AIRFOILS
Report on tests of a CAST 10 airfoil with fixed transition in the T2 transonic cryogenic wind tunnel with self-adaptive walls
[RT-OA-63/1685] N87-10834
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180
Surface protection N87-11182
Hot turbine heat transfer overview N87-11184
Development of heat flux sensors in turbine airfoils N87-11186
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221

AIRLINE OPERATIONS
Aviation statistics, 1984
[ISBN-90-357-0386-3] N87-10851
Engine performance monitoring for airlines
[PNR-90305] N87-10868

AIRPORTS
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10854

ALGEBRA
A survey of functional programming language principles
[NASA-TM-89019] N87-11506

ALGORITHMS
Experiments on the annotation of large quantities of speech using the ZIP dynamic time-warping algorithm
[RSRE-MEMO-3919] N87-11023
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Some recent developments in spectral methods
[NASA-CR-178178] N87-11127
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow
[NASA-TM-85948] N87-11143
Analysis of loop current step response data obtained from in situ tests of temperature detectors
[DE86-011750] N87-11147
Multiprocessing the Sieve of Eratosthenes
[NASA-CR-178131] N87-11509
Parallel processors and nonlinear structural dynamics algorithms and software
[NASA-CR-179689] N87-11511
Signal processing and interpretation using multilevel signal abstractions
[AD-A169166] N87-11513
Gaussian elimination on hypercubes
[AD-A169293] N87-11514

A fast algorithm for particle simulations
[AD-A169294] N87-11515
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516
Techniques for reducing Boolean evaluation time in Constructive Solid Geometry (CSG) scan-line algorithms — computer graphics
[REPT-85-43] N87-11529
A multivariable self-tuning controller with integral action
[REPT-86-002] N87-11539
Numerical algorithms for finite element computations on concurrent processors
[NASA-CR-179822] N87-11542
An iterative solution method for solving f(A)x=b, using cg-information obtained for the symmetric positive definite matrix A
[REPT-85-32] N87-11555
A convergence proof of a multigrid method
[REPT-85-39] N87-11556
An algorithm for rescaling a matrix positive definite
[AD-A169257] N87-11569

ALIGNMENT
New short-time alignment technique for 70-meter antenna surface panels N87-11026

ALKENES
Catalytic production of carboxylic acids or anhydrides from olefins
[GB-PATENT-2-140-004-A] N87-10983

ALTITUDE TESTS
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304

ALUMINUM
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994

ALUMINUM ALLOYS
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995
High temperature oxidation of alloys. Oxidation mechanisms and experimental methods
[ETN-86-98071] N87-11002
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials
[DFVLR-FB-86-16] N87-11003

AMMONIA
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179881] N87-11671

AMMONIUM NITRATES
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations
[AD-A168138] N87-10986

AMPLIFIER DESIGN
Active microwave instrumentation Traveling Wave Tube (TWT) amplifiers: Electrical modes, phase 2
[AMI/2/18] N87-11115

AMPLIFIERS
Radiofrequency amplifier based on a dc superconducting quantum interference device
[AD-D012353] N87-11109
Evolution of free-electron laser development
[DE86-008748] N87-11156

AMPLITUDES
Microstrip amplitude-weighted wilkinson power dividers
[AD-A169450] N87-11111

ANALOG SIMULATION
Simulation of the effect of atmospheric trace gases on the global average temperature distribution N87-11403

ANGLE OF ATTACK
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis
[NASA-CR-3608] N87-10836
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg
[NASA-CR-3747] N87-10837

ANGULAR MOMENTUM
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400

ANHYDRIDES
Catalytic production of carboxylic acids or anhydrides from olefins
[GB-PATENT-2-140-004-A] N87-10983

ANNUAL VARIATIONS
Variations of the water vapor content in the lower troposphere between 20 deg N and 20 deg S during the last 20 years N87-11368
The Martian climate and energy balance models with CO2/H2O atmospheres
[NASA-CR-179888] N87-11673

ANTARCTIC REGIONS
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Boundary layer investigations and aerological measurements at the Antarctic research station Georg von Neumayer N87-11442
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476

ANTENNA ARRAYS
VLA feedhorn for Voyager encounter of Neptune N87-11047
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061
Microstrip amplitude-weighted wilkinson power dividers
[AD-A169450] N87-11111

ANTENNA COMPONENTS
X-band preamplifier filter N87-11048

ANTENNA DESIGN
New short-time alignment technique for 70-meter antenna surface panels N87-11026
A prototype DSN X/S-band feed: Model 3 development N87-11027
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029
VLA feedhorn for Voyager encounter of Neptune N87-11047
Offset unfurlable antenna. Phase 2A: Executive summary — Intelsat, M-Sat
[MBB-R-0200/3089-R] N87-11066

ANTENNA FEEDS
A prototype DSN X/S-band feed: Model 3 development N87-11027
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029
VLA feedhorn for Voyager encounter of Neptune N87-11047
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060

ANTENNA RADIATION PATTERNS
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061

ANTHROPOMETRY
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

ANTIMISSILE MISSILES
The strategic defense initiative
[AD-A168147] N87-11644

APERIODIC FUNCTIONS
Investigation of the aperiodic behavior of the Southern Oscillation using methods of nonlinear systems analysis N87-11422

APERTURES
Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597

APPLICATIONS PROGRAMS (COMPUTERS)
Further development of the dynamic gas temperature measurement system N87-11185
Burner liner thermal/structural load modelling N87-11205
Design and implementation of the TUBA application generation system
[INF-85-23] N87-11524

ARC WELDING
A summary of gas shielded arc welding
[BAE-BT-14107] N87-11167

ARCHITECTURE
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267

ARCHITECTURE (COMPUTERS)
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
Advances in concurrent computers for autonomous robots
[DE86-006236] N87-11538

ARCTIC OCEAN
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384

ARCTIC REGIONS
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370

ARIANE LAUNCH VEHICLE
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures — vibration effects N87-10887
Verification of the mathematical model of the Ariane 4 payload fairing by means of extended modal survey testing N87-10902
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908
Investigation of the coupling of the Hermes vehicle to the Ariane 5 launcher N87-10937

ARID LANDS
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323

ARITHMETIC
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040

ARM (ANATOMY)
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

ARMED FORCES (UNITED STATES)
Model designation of military aerospace vehicles
[PB86-222429] N87-10831

ARTIFICIAL INTELLIGENCE
CESAR research in intelligent machines
[DE86-006226] N87-11494
Machine learning using a higher order correlation network
[DE86-010183] N87-11537
Reduction and reconstruction of control knowledge in rule based systems. Part 1: Reduction theory
[REPT-85-50] N87-11541
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645

ASPHALT
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia
[AD-A169284] N87-10877

ASSOCIATIVE PROCESSING (COMPUTERS)
Machine learning using a higher order correlation network
[DE86-010183] N87-11537

ASSURANCE
Radiation hardness assurance of electronic components, with special reference to semiconductor devices and evaluation statistics
[BAE-BT-13601] N87-11113

ASTRONOMICAL MODELS
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661

ASTRONOMICAL OBSERVATORIES
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/62351/BO] N87-11654

ASTRONOMICAL SPECTROSCOPY
High resolution spectroscopy of RS CVn stars N87-11657
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665

ASTRONOMICAL TELESCOPES
Development of a CCD camera for an automated supernova search and observations of a supernova in NGC 5033 N87-11660

ASYMPTOTIC SERIES
Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom
[NOTA-INTERNA-859] N87-11564

ATLANTIC OCEAN
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335
Vertical energy fluxes and meridional heat transport in the North Atlantic Ocean N87-11373
North Atlantic Oscillation (NAO) in ground pressure and its significance for the Atlantic-European area N87-11374
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423
Determination of the circulation in the North Atlantic Ocean from climatological data N87-11425

ATMOSPHERIC ATTENUATION
Propagation of signals in the frequency band between 30 MHz and 100 MHz
[AD-A169332] N87-11063
Heating of the atmosphere by particle absorption short wavelength radiation N87-11391
Sound propagation over uneven ground and irregular topography
[NASA-CR-179827] N87-11575

ATMOSPHERIC BOUNDARY LAYER
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244

Analysis of airborne measurements of the marine boundary layer during the TOSCANE experiment — scatterometry N87-11250
Physical processes in the atmospheric boundary layer at the pack-ice border N87-11394
Phenomenology of the evolution of large-scale boundary layer structures N87-11416
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431
Boundary layer investigations and aerological measurements at the Antarctic research station Georg von Neumayer N87-11442
Measurements in the ground level atmospheric layer during the experiment PUKK — wind, temperature, and moisture profiles N87-11449
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451
Evolution of sodar echoes as a climatological characteristic of the boundary layer N87-11459

ATMOSPHERIC CHEMISTRY
Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353
Activities report in meteorology
[AR-84/85] N87-11473

ATMOSPHERIC CIRCULATION
Anemothermographic remote sensing using airborne sensors: A new method of micrometeorological cartography N87-11291
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370
Diagnostic investigations of the intertropical convergent zone N87-11372
Climate-effective transport processes in the ocean N87-11380
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
The carbon exchange between atmosphere and terrestrial biosphere N87-11385
Physical processes in the atmospheric boundary layer at the pack-ice border N87-11394
Climate models with stochastic excitation N87-11396
Interactive coupling of oceanic top layer models and atmospheric circulation models N87-11399
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400
The response of the global atmosphere to the extraordinary El Nino sea surface temperature anomaly in January 1983: Simulation N87-11405
The significance of initialization for the unsteady simulation of mesoscale flows N87-11408
The dynamic basic structure of the Geesthacht (West Germany) mesoscale model N87-11409
A mesoscale climate model for the investigation of atmospheric flows under the influence of orography, turbulence, and cloud physics N87-11410
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417
Canalization of the atmospheric flow through valleys N87-11446
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456
Design and use of zonally-averaged climate models
[DE86-008764] N87-11465
The Martian climate and energy balance models with CO2/H2O atmospheres
[NASA-CR-179868] N87-11673

ATMOSPHERIC COMPOSITION
Challenge of detecting climate change induced by increasing carbon dioxide
[DE86-009704] N87-11467

ATMOSPHERIC EFFECTS
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304
An atmospheric correction method using Guzzi-spectroradiometer input data N87-11305
Estimation of atmospheric corrections from multiple aircraft imagery N87-11306
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435

ATMOSPHERIC HEAT BUDGET
Measurement of subscale climatological processes by diagnosis of scaled budgets N87-11381
The energy balances of selected types of surface in the Munich urban area N87-11429

ATMOSPHERIC HEATING
Heating of the atmosphere by particle absorption short wavelength radiation N87-11391

ATMOSPHERIC MODELS
Dry deposition parameterization in long range transport models — pollution transport
[KNMI-WR-86-1] N87-11354
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns
[ESA-CR(P)-2254] N87-11363
Subgrid parameterization in flows with helicity N87-11382
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11386
A two-dimensional numerical model for fog prognosis N87-11387
A comparison of several models for the calculation of ground temperature and ground moisture N87-11389
Measurement, calculation, and parameterization of atmospheric heat radiation N87-11390
Scale-dependent models for climatology N87-11398
Interactive coupling of oceanic top layer models and atmospheric circulation models N87-11399
Coupled ocean-atmosphere models without drift of the prognostic variables N87-11402
Simulation of the cloud coverage in a climate model N87-11404
Model simulations of the coastal experiment PUKK N87-11407
The significance of initialization for the unsteady simulation of mesoscale flows N87-11408
The dynamic basic structure of the Geesthacht (West Germany) mesoscale model N87-11409
A mesoscale climate model for the investigation of atmospheric flows under the influence of orography, turbulence, and cloud physics N87-11410
Numerical simulation of the urban climate using a 3-dimensional model N87-11411
Phenomenology of the evolution of large-scale boundary layer structures N87-11416
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417
A nonlinear theory of baroclinic instability N87-11418
Investigation of the aperiodic behavior of the Southern Oscillation using methods of nonlinear systems analysis N87-11422
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458
Design and use of zonally-averaged climate models
[DE86-008764] N87-11465

ATMOSPHERIC MOISTURE
Microwave sensing of atmospheric water using the future AMSU system N87-11307
Measurements in the ground level atmospheric layer during the experiment PUKK — wind, temperature, and moisture profiles N87-11449

ATMOSPHERIC OPTICS
Estimation of atmospheric corrections from multiple aircraft imagery N87-11306

ATMOSPHERIC PHYSICS
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Activities report in meteorology
[AR-84/85] N87-11473
Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597

ATMOSPHERIC PRESSURE
North Atlantic Oscillation (NAO) in ground pressure and its significance for the Atlantic-European area N87-11374
Local optimal determination of the wind field on sea from wind and pressure observations using an inverse method N87-11444

ATMOSPHERIC RADIATION
Accuracy analysis of satellite experiments for the measurement of the radiation budget N87-11379
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384
Measurement, calculation, and parameterization of atmospheric heat radiation N87-11390
Description of matter-radiation interactions as nonlinear irreversible processes N87-11420

ATMOSPHERIC REFRACTION
Tropospheric scatter communication system having angle diversity
[AD-D012263] N87-11058

ATMOSPHERIC SCATTERING
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304

ATMOSPHERIC SOUNDING
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295

ATMOSPHERIC TEMPERATURE
Modeling of the relation between air temperature and surface temperature for the spatial extension of surface parameter analysis models N87-11266
The influence of volcanics on the ground level air temperature (1781-1984) N87-11371
Statistical analysis of secular temperature series N87-11376
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Simulation of the effect of atmospheric trace gases on the global average temperature distribution N87-11403
The variability of sea surface temperatures N87-11460

ATMOSPHERIC TURBULENCE
Subgrid parameterization in flows with helicity N87-11382
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384

ATOMIC SPECTRA
A new way of organizing spectral line intensity ratio fluctuations of different elements
[KGI-PREPRINT-068] N87-10989

ATTACKING (ASSAULTING)
The strategic defense initiative
[AD-A168147] N87-11644

AURORAL SPECTROSCOPY
A new method of organizing spectral line intensity ratio fluctuations of auroral emissions
[KGI-PREPRINT-069] N87-11362

AUTOMATIC CONTROL
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
Unattended deep space station tracking station development: Monitor and control technology N87-11042
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150
Development of precision turning capabilities at Lawrence Livermore National Laboratory
[DE86-011884] N87-11162
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535
Microcomputer-based local automation model: System planning guidance
[AD-A168136] N87-11630

AUTOMATIC FLIGHT CONTROL
Piloted simulation study of the effects of an automated trim system on flight characteristics of a light twin-engine airplane with one engine inoperative
[NASA-TP-2633] N87-10643
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10654
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872

AUTOMATIC TEST EQUIPMENT
Satellite battery testing status N87-11091

AUTOMATION
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10683

AUTOMOBILE ENGINES
Automotive Technology Development Program
[DE86-010683] N87-11163

AUTOMOBILE FUELS
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014

AUTOMOBILES
Grid generation around car configurations above a flat ground plane using transfinite interpolation
[FFA-139] N87-11545

AUTONOMOUS NAVIGATION
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855

AVIONICS
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
Low-cost avionics simulation for aircrew training
[AD-A169198] N87-10865
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90298] N87-10867

AXIAL COMPRESSION LOADS
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942

AXISYMMETRIC BODIES
Static internal performance of single-expansion-ramp nozzles with thrust-vectoring capability up to 60 deg
[NASA-TP-2364] N87-10839
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908

B

BACKGROUND RADIATION
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656

BACKSCATTERING
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
Backscatter measurements from simulated vegetation structures N87-11254
Experiments on modeling radar backscatter of forest stands and research on classification N87-11259
Wind tunnel investigation of the characterization of radar backscattering by different wave fields — sea waves N87-11261
Scattering models for coniferous and deciduous vegetation N87-11263
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method — soil emissivity; laser scattering N87-11279
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
Measurements of microwave backscatter from trees N87-11318

BALLOON-BORNE INSTRUMENTS
Gamma ray astronomy from satellites and balloons
[MPE-PREPRINT-39] N87-11650

BANDPASS FILTERS
Development of equipment for the 20/30 GHz payload of a satellite for propagation and transmission experiments
[BMFT-FB-W-85-035] N87-10948

BANDSTOP FILTERS
X-band preamplifier filter N87-11048

BARIUM ION CLOUDS
Active plasma experiments — Active Magnetic Particle Tracer Explorers (AMPTE) project
[MPE-PREPRINT-43] N87-11603

BARLEY
Reflectance properties of barley for different agronomical treatments N87-11326

BAROCLINIC INSTABILITY
A nonlinear theory of baroclinic instability N87-11418

BAROCLINIC WAVES
A nonlinear theory of baroclinic instability N87-11418

BASALT
Laboratory measurements of spectral reflectance (0.4 to 2.3 micron) of basalts N87-11332

BAYS (STRUCTURAL UNITS)
Acoustic load considerations for spacecraft structures — Space Shuttle N87-10905

BAYS (TOPOGRAPHIC FEATURES)
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283

BEAMS (RADIATION)
Optical filtering techniques
[AD-A168084] N87-11596

BERING SEA
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453

BESSEL FUNCTIONS
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150

BIBLIOGRAPHIES
A bibliography of aerodynamic heating references
[BAE-BT-13481] N87-10832

BINARY MIXTURES
Nucleation in binary supersaturated gas mixtures
[KFK-4036] N87-11581

BINARY STARS
UV observations of blue stragglers and population 2 K dwarfs
[NASA-CR-179865] N87-11653
High resolution spectroscopy of RS CVn stars N87-11657

BIOCHEMISTRY
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645

BIOLOGICAL MODELS (MATHEMATICS)
The evaporation of several types of vegetation and its modeling by a simple inventory climate model N87-11386

BIOMASS
Spectral measurements for estimation of biomass on limestone grassland N87-11319

BIOSPHERE
The carbon exchange between atmosphere and terrestrial biosphere N87-11385

BIPOLARITY
Develop and test fuel cell powered on-site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175117] N87-11346

BIRDS
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-008904] N87-11337

BISTABLE CIRCUITS
Optical flip-flop system
[AD-D012259] N87-11593

BIT SYNCHRONIZATION
A new method for frame synchronization N87-11037

BLACK HOLES (ASTRONOMY)
On the radiation emitted by a particle falling into a black hole in the semirelativistic approximation
[NOTA-INTERNA-857] N87-11664
Vacuum polarization on black hole spacetimes N87-11668

BLADE TIPS
Parametric analysis of a passive cyclic control device for helicopters
[NASA-CR-166606] N87-10862

BLOCKING
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400

BLUE STARS
UV observations of blue stragglers and population 2 K dwarfs
[NASA-CR-179865] N87-11653

BODY KINEMATICS
Kinematic analysis of a large deployable truss antenna — spacecraft antenna N87-10941

BOLTS
Critical joints in large composite aircraft structure
[NASA-CR-3710] N87-10973
Critical composite joint subcomponents: Analysis and test results
[NASA-CR-3711] N87-10975

BOMBER AIRCRAFT
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226

BOOLEAN ALGEBRA
Translation and optimization of logic queries: The algebraic approach — data bases
[REPT-86-004] N87-11631

BOOLEAN FUNCTIONS
Techniques for reducing Boolean evaluation time in Constructive Solid Geometry (CSG) scan-line algorithms — computer graphics
[REPT-85-43] N87-11529
A note on prime terms — Boolean functions
[INF-85-5] N87-11550

BOOMS (EQUIPMENT)
The effect of the non-uniform stress distribution in the blankets of single and twin boom solar array panels upon their modal characteristics N87-10904

BORANES
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987

BOSONS
Electroweak interactions
[PREPRINT-482] N87-11588

BOUNDARY LAYER FLOW
Dynamics of the marine boundary layer. Detailed formulation of boundary conditions N87-11244

BOUNDARY LAYER PLASMAS
The current system generated by the PORCUPINE artificial ion beam in the ionospheric background plasma
[MPE-PREPRINT-49] N87-11355
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605

BOUNDARY LAYER SEPARATION
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129

BOUNDARY LAYER TRANSITION
Report on tests of a CAST 10 airfoil with fixed transition in the T2 transonic cryogenic wind tunnel with self-adaptive walls
[RT-OA-63/1685] N87-10834

BOUNDARY LAYERS
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179832] N87-11123

BOUNDARY VALUE PROBLEMS
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128
Mass and momentum turbulent transport experiments N87-11201
The significance of initialization for the unsteady simulation of mesoscale flows N87-11408
On the numerical integration of second-order initial value problems with a periodic forcing function
[CWI-NM-R8604] N87-11581
Convergence analysis of one-step schemes in the method of lines
[CWI-NM-R8608] N87-11583

BRAYTON CYCLE
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349

BREADBOARD MODELS
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard — spaceborne radar
[ESA-CR(P)-2249] N87-11116

BROADBAND
La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October
[ESA-TT-964] N87-11131

BROKEN SYMMETRY
Quantum effects in non-maximally symmetric spaces N87-11669

BRUSHES (ELECTRICAL CONTACTS)
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108

BUBBLES
Study on a drop and bubble unit. Volume 1: Executive study — spaceborne experiments
[ESA-CR(P)-2256] N87-10881
Bubble Drop and Particle Unit (BOPU) project — ESA microgravity program
[BO-RP-AI-004] N87-11016

BUCKLING
Analysis of long thin-walled tubes — large space structures N87-10895

BUOYANCY
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992

BUOYS
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426

BURNERS
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11102
High temperature stress-strain analysis N87-11209

C

C BAND
An experimental campaign for the determination of radar structure of the ocean at C band N87-11239
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Analysis and calibration of the Dutch scatterometer measurements N87-11246

SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
The C and Ku band scatterometer results from Canadian participation in the ESA PROMESS ocean measurement campaign N87-11252

CALCIUM CARBONATES
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study [AD-A169398] N87-10976

CALIBRATING
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986 [PB86-206364] N87-11021
New short-time alignment technique for 70-meter antenna surface panels N87-11026
A fast response thermal conductivity gage [AD-A168185] N87-11146
NBS (National Bureau of Standards) 50 kHz phase angle calibration standard [PB85-201274] N87-11151
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
In-flight calibration during PROMESS campaign — radar targets N87-11245
Analysis and calibration of the Dutch scatterometer measurements N87-11246
Absolute calibration of remote sensing instruments N87-11292
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11298
Calibrated microwave signature measurements of soil and wheat N87-11299
Multivariate calibration: A generalization of the classical estimator [REPT-85-31] N87-11565

CAMBERED WINGS
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations [NASA-CR-3806] N87-10829

CAMERA SHUTTERS
Method and apparatus for high speed, sustained recording of infrared laser beam patterns [AD-D012265] N87-11154

CANOPIES (VEGETATION)
Canopy reflectance modeling in a tropical wooded grassland [NASA-CR-179895] N87-11237
The effect of electromagnetic wave polarization on wave attenuation in a vegetation canopy N87-11257
Modelisation of the optical scattering behaviour of the vegetation canopies N87-11264
Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11265
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267
Reconstruction of vegetation spectra from soil plant canopies N87-11268
Geometric model simulations of conifer canopy reflectance N87-11269
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
The evaporation of several types of vegetation and its modeling by a simple inventory climate model N87-11386

CARBON CYCLE
The carbon exchange between atmosphere and terrestrial biosphere N87-11385

CARBON DIOXIDE
The Martian climate and energy balance models with CO2/H2O atmospheres [NASA-CR-179886] N87-11673

CARBON DIOXIDE CONCENTRATION
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
Challenge of detecting climate change induced by increasing carbon dioxide [DE86-009704] N87-11467
Data bases for isolating the effects of the increasing carbon dioxide concentration [DE86-009709] N87-11469

CARBON DIOXIDE LASERS
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method — soil emissivity; laser scattering N87-11279
The CO2 laser imaging spectroscopy for Earth observation N87-11285

CARBON FIBER REINFORCED PLASTICS
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942
Material selection for carbon fiber reinforced composite structures — conferences [ESA-TT-950] N87-10965
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials [DFVLR-FB-86-16] N87-11003

CARBON FIBERS
Choice of resin when using different carbon fiber types N87-10969
The interface between fiber and matrix resin from a chemical point of view N87-10970
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
The crystallization of tough thermoplastic resins in the presence of carbon fibers [NASA-CR-179810] N87-11006

CARBORANE
Metal ion-promoted syntheses of boranes and carboranes [AD-A169189] N87-10987

CARBOXYLIC ACIDS
Catalytic production of carboxylic acids or anhydrides from olefins [GB-PATENT-2-140-004-A] N87-10983

CARGO
National Transportation Safety Board safety recommendation N87-10852

CARRIER FREQUENCIES
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035
A method to dramatically improve subcarrier tracking N87-11036

CASCADE CONTROL
Performance analysis of a cascaded coding scheme with interleaved outer code [NASA-CR-179869] N87-11512

CASCADE WIND TUNNELS
The high speed cascade wind tunnel: Still an important test facility for investigations on turbomachinery blades [DFVLR-MITT-86-11] N87-10878

CASSEGRAIN ANTENNAS
A prototype DSN X/S-band feed: Model 3 development N87-11027

CATALYSIS
Catalytic production of carboxylic acids or anhydrides from olefins [GB-PATENT-2-140-004-A] N87-10983

CAVITIES
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods [AD-A168186] N87-11160

CCD STAR TRACKER
Development of a CCD camera for an automated supernova search and observations of a supernova in NGC 5033 N87-11660

CEILINGS (METEOROLOGY)
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436

CELESTIAL MECHANICS
A fast algorithm for particle simulations [AD-A169294] N87-11515
Resonance capture and Saturn's rings [DE86-011733] N87-11674

CELLS (BIOLOGY)
Effects of long-term radiofrequency radiation on immunological competence and metabolism [AD-A169064] N87-11479

CERAMICS
Whisker-reinforced ceramic composites [DE86-011058] N87-10980
Strain contrast in SiC whisker reinforced Al sub 2 O sub 3 [DE86-009537] N87-10981
Current Awareness Bulletin: Metals and Ceramics [CAB-160] N87-10995
Fractal aspects of ceramic synthesis [DE86-011657] N87-11012
Automotive Technology Development Program [DE86-010883] N87-11163

CERTIFICATION
A summary of DO-178A — airborne software certification [PNR-90294] N87-11518

CHALLENGER (ORBITER)
Structural behavior of the space shuttle SRM Tang-Clevis joint [NASA-TM-89018] N87-11177

CHANNELS (DATA TRANSMISSION)
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Gaussian noise channel N87-11034

CHARACTERIZATION
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322

CHARGE COUPLED DEVICES
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11298

CHARGE EFFICIENCY
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
A 65 Ah rechargeable lithium molybdenum disulfide battery N87-11082
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
Parametric tests of a 40-Ah bipolar nickel-hydrogen battery N87-11100

CHECKOUT
Real time debugging software package for flight simulator software system with variable labeled COMMON blocks [NLR-MP-85013-U] N87-11530

CHELATION
Anaerobic microbial transformations in subsurface environments: Highlights [DE86-008703] N87-11480

CHEMICAL ANALYSIS
The interface between fiber and matrix resin from a chemical point of view N87-10970
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints [AD-A169346] N87-11476

CHEMICAL COMPOSITION
Combined ultraviolet studies of astronomical sources [NASA-CR-179784] N87-11651
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665

CHEMICAL PROPERTIES
Calculating and predicting the properties of materials [DE86-011557] N87-10964

CHEMICAL REACTIONS
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties [NASA-CR-177058] N87-11007
Computational solution of atmospheric chemistry problems [NASA-CR-179803] N87-11353
Chemical reaction in shock compression of solids [DE86-003502] N87-11611

CHEMISORPTION
Stability of UV optical coatings in hostile excimer laser environments [AD-A169406] N87-11155

CHINA
Spectral study of rocks and some iron deposits from Eastern China N87-11308
Spectral features of rocks and minerals from Beiyunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333

CHIPS (ELECTRONICS)
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044

CHLOROPHYLLS
In-vivo chlorophyll determination of plants by laser-induced fluorometer N87-11287
CHROMIUM STEELS
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
Comparison of the effects of alloyed molybdenum and aqueous molybdate on the pitting resistance of iron-chromium alloys
[DE86-011918] N87-10997
CIRCLES (GEOMETRY)
ARC-OLOGY via TELL-A-GRAF
[DE86-009698] N87-11517
CIRCUIT BOARDS
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676
CIRCULAR POLARIZATION
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169084] N87-11479
CIRCULAR WAVEGUIDES
Components for transmission of very high power mm waves (200 kW at 28, 70 and 140 GHz) in overmoded circular waveguides — plasmaguides
[IPF-86-2] N87-11068
CITIES
Numerical simulation of the urban climate using a 3-dimensional model N87-11411
The energy balances of selected types of surface in the Munich urban area N87-11429
CITRUS TREES
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334
CIVIL AVIATION
Aviation statistics, 1984
[ISBN-90-357-0386-3] N87-10851
CLASSIFICATIONS
Experiments on modeling radar backscatter of forest stands and research on classification N87-11259
Characterising vegetated surfaces with airborne MSS data — Multispectral Scanner (MSS) N87-11315
CLEANING
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018
Silicon wafer cleaning for integrated circuit fabrication
[RSRE-MEMO-3907] N87-11071
CLIMATE
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment
[ISBN-3-88148-226-1] N87-11367
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Climate models: Their application in the investigation of trace gases and the impact on climate N87-11397
Climate models with stochastic excitation N87-11398
Simulation of the cloud coverage in a climate model N87-11404
A mesoscale climate model for the investigation of atmospheric flows under the influence of orography, turbulence, and cloud physics N87-11410
Numerical simulation of the urban climate using a 3-dimensional model N87-11411
The energy balances of selected types of surface in the Munich urban area N87-11429
Climatological data of the Federal Republic of Germany N87-11443
Change of the local climate by deforestation. A numerical simulation experiment N87-11447
Design and use of zonally-averaged climate models
[DE86-008764] N87-11465
Challenge of detecting climate change induced by increasing carbon dioxide
[DE86-009704] N87-11467
Long-term climate change in observed physical properties of the oceans
[DE86-009706] N87-11468
CLIMATOLOGY
The First International Satellite Land-Surface Climatology Project (ISLSCP) Field Experiment (FIFE) N87-11294
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375
A method for correlation analysis in climatology N87-11378
Climate-effective transport processes in the ocean N87-11380
Measurement of subscale climatological processes by diagnosis of scaled budgets N87-11381
Scale-dependent models for climatology N87-11396
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436
Hydrological behavior pattern of isolated lakes and their role in paleoclimatology N87-11438
Climatological data of the Federal Republic of Germany N87-11443
Evolution of sodar echoes as a climatological characteristic of the boundary layer N87-11459
Constructing a coherent long-term global total ozone climatology from the BUV, MFR, and SBUV/TOMS data sets
[DE86-009722] N87-11470
CLOCKS
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
CLOUD COVER
A simple parameterization scheme for the determination of the relative coverage by cumulus clouds N87-11393
Simulation of the cloud coverage in a climate model N87-11404
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462
CLOUD GLACIATION
Ice accretion dependence on cloud physical parameters N87-11433
CLOUD PHOTOGRAPHS
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462
CLOUD PHOTOGRAPHY
Operational evaluation of METEOSAT data N87-11455
CLOUD PHYSICS
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384
Simulation of the cloud coverage in a climate model N87-11404
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
Thermodynamic aspects of the absorption of gas in droplets N87-11421
Ice accretion dependence on cloud physical parameters N87-11433
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
Test of a simple cloud model with precipitation N87-11452
CLOUDS (METEOROLOGY)
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
A comparison between detailed and parameterized formulations of droplet/droplet coagulation mechanisms N87-11392
Cloud parameterization with a statistical method N87-11401
Solar radiation transport in realistic atmospheres with 3-dimensional cloud fields N87-11412
CMOS
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044
COAGULATION
A comparison between detailed and parameterized formulations of droplet/droplet coagulation mechanisms N87-11392
COASTAL CURRENTS
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445
COASTAL ECOLOGY
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283
COASTAL WATER
Spectral signatures of coastal objects N87-11282
COASTS
Model simulations of the coastal experiment PUKK N87-11407
Measurements in the ground level atmospheric layer during the experiment PUKK — wind, temperature, and moisture profiles N87-11449
COATINGS
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
COAXIAL CABLES
Printed circuit transmission line transitions
[AD-A169291] N87-11110
COBALT ALLOYS
High temperature static strain gage program N87-11188
CODING
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
Analysis of loop current step response data obtained from in situ tests of temperature detectors
[DE86-011750] N87-11147
Burner liner thermal/structural load modelling N87-11205
Gas flow environmental and heat transfer nonrotating 3D program N87-11223
Performance analysis of a cascaded coding scheme with interleaved outer code
[NASA-CR-179869] N87-11512
COEFFICIENT OF FRICTION
Changes in the turbulent boundary layer structure associated with net drag reduction by outer layer manipulators N87-10850
COHERENT LIGHT
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A168042] N87-11595
COINING
The prediction of tool pressures in coining
[WPB-0132] N87-11173
COLD FRONTS
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453
COLLAPSE
An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse
[NOTA-INTERNA-855] N87-11623
COLLISIONAL PLASMAS
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
COLOR PHOTOGRAPHY
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335
COLOR VISION
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12489-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12489-VOL-2] N87-11491
COLUMNS (SUPPORTS)
Passive damping concepts for slender columns in space structures
[NASA-CR-179807] N87-11178
COMBINATORIAL ANALYSIS
A family of Fibonacci-like sequences
[INF-85-10] N87-11570
COMBUSTION CHAMBERS
Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991
Hot section viewing system
[NASA-CR-174773] N87-11144
Combustion overview N87-11181
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190
Lateral jet injection into typical combustor flowfields N87-11203
Flame radiation N87-11204
Burner liner thermal/structural load modelling N87-11205
The 3-D inelastic analysis methods for hot section components (base program) N87-11206
Effects of very high turbulence on convective heat transfer N87-11222
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345
COMBUSTION PHYSICS
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992
La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October
[ESA-TT-964] N87-11131
COMMUNICATION NETWORKS
Deep space network Mark 4A description N87-11051
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 2: Fiber optic technology and long distance networks
[NASA-CR-179480] N87-11057
COMMUNICATION SATELLITES
Experience on the Olympus modal survey test N87-10919
COMPARISON
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014

COMPATIBILITY
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108

COMPENSATORS
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046

COMPLEX COMPOUNDS
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987

COMPLEX NUMBERS
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041

COMPONENT RELIABILITY
Aerospace nickel-cadmium cell separator qualifications program N87-11085
Nickel hydrogen low Earth orbit life testing N87-11102
The 4.5 inch diameter IPV Ni-H2 cell development program N87-11103

COMPOSITE FUNCTIONS
Time series analysis and composite analysis of equatorial observations from ships N87-11377

COMPOSITE MATERIALS
A method of studying the behavior of composite materials in simulated space environments N87-10940
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading
[NASA-CR-179667] N87-10976
The effects of space radiation on a chemically modified graphite-epoxy composite material
[NASA-TM-89232] N87-10977
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study
[AD-A169398] N87-10978
Model for prediction of the elastic response of composite materials over wide ranges of concentration
[AD-A169399] N87-10979
Whisker-reinforced ceramic composites
[DE86-011058] N87-10980
Automotive Technology Development Program
[DE86-010883] N87-11163
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579

COMPOSITE STRUCTURES
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Tele-X antenna module structure qualification program N87-10924
Critical element concepts for composite structures N87-10930
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972
Critical joints in large composite aircraft structure
[NASA-CR-3710] N87-10973
DC-10 composite vertical stabilizer ground test program
[NASA-CR-3715] N87-10974
Critical composite joint subcomponents: Analysis and test results
[NASA-CR-3711] N87-10975
Composites design handbook for space structure applications. Executive summary
[ESA-CR(P)-2196] N87-10982

COMPRESSIBLE FLOW
Unsteady airload computations for airfoils oscillating in attached and separated compressible flow
[NLR-MP-85040-U] N87-10846
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
Multigrid approaches to the Euler equations — compressible flow
[CWI-NM-R8602] N87-11140

COMPRESSIBLE FLUIDS
Direct numerical simulation of homogeneous strained turbulence N87-11120

COMPRESSING
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620

COMPRESSORS
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164
Heat exchangeable liquid injected compressors
[ETN-86-97852] N87-11166

COMPUTATION
Calculating and predicting the properties of materials
[DE86-011557] N87-10964
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516

COMPUTATIONAL CHEMISTRY
Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353

COMPUTATIONAL FLUID DYNAMICS
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
Advanced method for computing the flow around wings with rear separation and ground effect
[DFVLR-FB-86-17] N87-11017
La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August
[ESA-TT-960] N87-11019
Computational Fluid Dynamics, volume 2 — conference
[VKI-LS-1986-04-VOL-2] N87-11119
Direct numerical simulation of homogeneous strained turbulence N87-11120
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
The solution of the parabolized Navier-Stokes equations
[CFD/86/2] N87-11130
A theory of fractal fluids
[KFK-4070] N87-11134
Mass and momentum turbulent transport experiments N87-11201
Lateral jet injection into typical combustor flowfields N87-11203
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
Gas flow environmental and heat transfer nonrotating 3D program N87-11223
Coolant passage heat transfer with rotation, a progress report N87-11225
Turbulence theory from a present-day point of view N87-11415

COMPUTATIONAL GRIDS
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October
[ESA-TT-964] N87-11131
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
Grid generation around car configurations above a flat ground plane using transfinite interpolation
[FFA-139] N87-11545
A convergence proof of a multigrid method
[REPT-85-39] N87-11556

COMPUTER AIDED DESIGN
About the development of interactive shell design codes N87-10689
Engineering and software interfacing for thermal, structural and attitude control related with spacecraft N87-10928
Ulysses: A functional description and simulation software system N87-11045
Computer aided design of robot manipulators and their operations
[NLR-MP-85012-U] N87-11172
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies
[KFK-PFT-119] N87-11500
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
Practical experience with the application of CAD/CAM to a medium-size company N87-11502
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676

COMPUTER AIDED MANUFACTURING
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies
[KFK-PFT-119] N87-11500
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
Practical experience with the application of CAD/CAM to a medium-size company N87-11502
Manufacturing planning in machine building from the point of view of management and workshop personnel N87-11503

COMPUTER ASSISTED INSTRUCTION
Low-cost avionics simulation for aircrew training
[AD-A169198] N87-10865
Computer aided education in the choice of studies
[REPT-85-29] N87-11528

COMPUTER DESIGN
The Array Processor with Emulator (APE) project: A computer for lattice QCD
[NOTA-INTERNA-639] N87-11495

COMPUTER GRAPHICS
ARC-OLOGY via TELL-A-GRAF
[DE86-009698] N87-11517
Techniques for reducing Boolean evaluation time in Constructive Solid Geometry (CSG) scan-line algorithms — computer graphics
[REPT-85-43] N87-11529

COMPUTER NETWORKS
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
Guide to sharing personal computer resources via local area networks
[DE86-009665] N87-11532
A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540

COMPUTER PROGRAMMING
The use of values without names in a programming support environment — Flex programming support environment
[RSRE-MEMO-3901] N87-11498
Orwellian programming in safety-critical systems
[RSRE-MEMO-3924] N87-11499
Gaussian elimination on hypercubes
[AD-A169293] N87-11514
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide
[NASA-CR-178051] N87-11536
Making a simple relational database system
[INF-84-18] N87-11633

COMPUTER PROGRAMS
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations
[NASA-CR-3808] N87-10829
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
MEPRO: A volume of IMIS procedures for the use of the operational-meteorological practice
[REPT-84-2] N87-11474
Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507
Improved two-dimensional-kinetics computer program
[NASA-CR-179782] N87-11508
Introduction to the Tools for User-Friendly Business Applications (TUBA) system
[INF-85-24] N87-11526
Real time debugging software package for flight simulator software system with variable labeled COMMON blocks
[NLR-MP-85013-U] N87-11530
Propeller aircraft interior noise model utilization study and validation
[NASA-CR-172428] N87-11576

COMPUTER STORAGE DEVICES
An assessment of CD ROM (Compact Disk Read Only Memory)
[AD-A169259] N87-11492

COMPUTER SYSTEMS DESIGN
TUMULT: A distributed real-time multi-processor system
[INF-85-3] N87-11496

High speed programmable processor for use on board satellites
[EPT/DI/008/GG/TT] N87-11497
EOS: A project to investigate the design and construction of real-time distributed embedded operating systems
[NASA-CR-179874] N87-11510
A survey of the Twente University MULTIprocessor (TUMULT) system, a real time multiprocessor system
[INF-85-22] N87-11533
Advances in concurrent computers for autonomous robots
[DE86-008236] N87-11538
A modeling approach to information system development
[INF-85-29] N87-11635

COMPUTER SYSTEMS PERFORMANCE
Guide to sharing personal computer resources via local area networks
[DE86-009665] N87-11532
Support for the design and the implementation of the spacecraft performance evaluation services — data base management, ESA
[ESOC/85/1] N87-11632

COMPUTER SYSTEMS PROGRAMS
Engineering and software interfacing for thermal, structural and attitude control related with spacecraft N87-10928
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
Ulysses: A functional description and simulation software system N87-11045
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293
A summary of DO-178A — airborne software certification
[PNR-90294] N87-11518
Computer program TRAMP: Further extensions — linear feedback systems analysis program
[BAE-BT-13621] N87-11520
The IMIS program NESO
[REPT-84-1] N87-11521
Interactive data analysis
[DFVLR-MITT-86-07] N87-11525
Introduction to the Tools for User-Friendly Business Applications (TUBA) system
[INF-85-24] N87-11526
Real time debugging software package for flight simulator software system with variable labeled COMMON blocks
[NLR-MP-85013-U] N87-11530

COMPUTER TECHNIQUES
Numerical algorithms for finite element computations on concurrent processors
[NASA-CR-179822] N87-11542

COMPUTER VISION
CESAR research in intelligent machines
[DE86-008226] N87-11494

COMPUTERIZED SIMULATION
Physical metallurgy issues in solder joint performance
[DE86-010981] N87-10999
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043
Ulysses: A functional description and simulation software system N87-11045
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Lateral jet injection into typical combustor flowfields N87-11203
Current problems in solid dynamics
[DE86-011653] N87-11229
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349
Computer simulation of the dynamics of the near-earth part of the geomagnetic tail
[AD-A169449] N87-11359
Real-time integration formulas with off-step inputs and their stability
[DE86-011652] N87-11516
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide
[NASA-CR-178051] N87-11536
Molecular dynamics simulation of rigid molecules
[PREPRINT-494] N87-11587
Simulation of the preliminary General Electric SP-100 space reactor concept using the ATHENA computer code
[DE86-005324] N87-11590

COMPUTERS
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108

CONCAVITY
Concave diffraction gratings
[NPL-MOM-77] N87-11592

CONCENTRATION (COMPOSITION)
Determination of the mass concentration of the particles in aerosols using the sound velocity measurement
[FR-235/20-1] N87-11574

CONCRETES
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia
[AD-A169264] N87-10877

CONCURRENT PROCESSING
Advances in concurrent computers for autonomous robots
[DE86-008236] N87-11538
Numerical algorithms for finite element computations on concurrent processors
[NASA-CR-179822] N87-11542

CONFERENCES
Proceedings of an International Conference on Spacecraft Structures
[ESA-SP-238] N87-10888
Material selection for carbon fiber reinforced composite structures — conferences
[ESA-TT-950] N87-10965
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995
The 1985 Goddard Space Flight Center Battery Workshop
[NASA-CP-2434] N87-11072
Computational Fluid Dynamics, volume 2 — conference
[VKI-LS-1986-04-VOL-2] N87-11119
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180
Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing — conference
[ESA-SP-247] N87-11238
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment
[ISBN-3-88148-228-1] N87-11367
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572

CONFORMAL MAPPING
On restrictions of projections along separable metric spaces
[REPT-85-42] N87-11571

CONGRESSIONAL REPORTS
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986
[H-REPT-99-829] N87-11641
NASA Space Program
[S-HRG-99-691] N87-11642
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643

CONIFERS
Scattering models for coniferous and deciduous vegetation N87-11263
Geometric model simulations of conifer canopy reflectance N87-11269
In-vivo chlorophyll determination of plants by laser-induced fluorometer N87-11287
Reflectance properties of conifers, measured from a helicopter N87-11321

CONJUGATE GRADIENT METHOD
An iterative solution method for solving f(A)x=b, using cg-information obtained for the symmetric positive definite matrix A
[REPT-85-32] N87-11555

CONSERVATION LAWS
Diagonally implicit Runge-Kutta methods for parabolic equations in conservation law form
[PREPRINT-980] N87-11552

CONSTITUTIVE EQUATIONS
Constitutive modeling of inelastic anisotropic material response N87-11216
Biaxial constitutive equation development N87-11217

CONTAMINATION
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018

CONTINENTS
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335

CONTINGENCY
A method for correlation analysis in climatology N87-11378

CONTINUUM MECHANICS
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621

CONTINUUM MODELING
Equivalent continuum analyses of large space trusses N87-10894

CONTRAST
Strain contrast in SiC whisker reinforced Al sub 2 O sub 3
[DE86-009637] N87-10981

CONTROL BOARDS
Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489

CONTROL STABILITY
On robots with flexible links: Dynamics, control and stability
[REPT-85-34] N87-11171

CONTROL SURFACES
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108

CONTROL SYSTEMS DESIGN
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90296] N87-10867
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
On optimal passive and active control of precision spacecraft structures N87-10891
On a simple vibration control design for large space structure models with uncertain parameters N87-10903
Proceedings of the 2nd Annual SCOLE Workshop
[NASA-TM-89048] N87-10945
Control of a free-flying robot manipulator system
[NASA-CR-179877] N87-11159
Performance characteristics of a low speed hydraulic motor driving a position control system
[BAE-BT-14978] N87-11168
Characterization and control of object acquisition using a robot hand N87-11174
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345
CESAR research in intelligent machines
[DE86-008226] N87-11494
A multivariable self-tuning controller with integral action
[REPT-86-002] N87-11539
A methodology for designing robust multivariable nonlinear control systems
[NASA-CR-179891] N87-11567

CONTROL THEORY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
Modern control of large flexible spacecraft, ESA ASTP study
[BL-6206-ISSUE-2] N87-10956
Reduction and reconstruction of control knowledge in rule based systems. Part 1: Reduction theory
[REPT-85-50] N87-11541

CONTROLLERS
Unattended deep space station tracking station development: Monitor and control technology N87-11042
A multivariable self-tuning controller with integral action
[REPT-86-002] N87-11539

CONVECTION
On numerical dispersion by upwind differencing
[REPT-85-51] N87-11558

CONVECTION CLOUDS
Test of a simple cloud model with precipitation N87-11452

CONVERGENCE
A convergence proof of a multigrid method
[REPT-85-39] N87-11556
The order of B-convergence of algebraically stable Runge-Kutta methods
[CWI-NM-R8607] N87-11562

Convergence analysis of one-step schemes in the method of lines
[CWI-NM-R8606] N87-11563
COOLING
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345
The influence of volcanics on the ground level air temperature (1781-1984) N87-11371
Stress and efficiency studies in EFG
[NASA-CR-179814] N87-11618
COOLING FINS
Conduction investigations into the magnetic properties of matter
[NASA-CR-179868] N87-11126
COOLING SYSTEMS
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
Coolant passage heat transfer with rotation, a progress report N87-11225
CORRECTION
Comparison of modal to nodal approaches for wavefront correction
[AD-A168068] N87-11597
CORRELATION COEFFICIENTS
A method for correlation analysis in climatology N87-11378
CORROSION
Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts
[DE86-011778] N87-11000
Corrosion and corrosion prevention in aircraft structures
[NLR-MP-85029-U] N87-11004
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338
CORROSION PREVENTION
Corrosion and corrosion prevention in aircraft structures
[NLR-MP-85029-U] N87-11004
CORROSION RESISTANCE
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995
Comparison of the effects of alloyed molybdenum and aqueous molybdate on the pitting resistance of iron-chromium alloys
[DE86-011918] N87-10997
COSMIC RAY SHOWERS
Scaling violation in hadronic interactions and the deep underground flux of cosmic muons — particle collision experiment
[PREPRINT-495] N87-11682
COSMIC RAYS
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data
[PB86-213865] N87-11365
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179863] N87-11672
COSMOCHEMISTRY
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670
COSMOLOGY
Photometric redshifts and cosmology N87-11658
COST ANALYSIS
Economic study for NAVSAT
[GTS-84051] N87-11568
COST EFFECTIVENESS
The 3D inelastic analysis methods for hot section components N87-11206
Cost effective single crystals — gas turbine components
[PNR-90319] N87-11615
COST ESTIMATES
GRANAS: Global Radio Navigation System
[BMFT-FB-W-85-034] N87-10857
Microcomputer-based local automation model: System planning guidance
[AD-A166136] N87-11630
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning system
[ESA-CR(P)-2213-VOL-1] N87-11638
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning
[ESA-CR(P)-2213-VOL-2] N87-11639
COST REDUCTION
Reliability and economics of spacecraft structure development N87-10921
Net shape forming: The route to low cost components. The view point of the aerospace industry
[PNR-90306] N87-11020
COUETTE FLOW
Finite length effects in Taylor-Couette flow
[NASA-CR-178175] N87-11125
COUNTER ROTATION
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg
[NASA-CR-3747] N87-10837
Effect of angular inflow on the vibratory response of a counter-rotating propeller
[NASA-CR-174819] N87-10840
COUNTERFLOW
Conduction investigations into the magnetic properties of matter
[NASA-CR-179868] N87-11126
COUPLED MODES
A study of nodal coupling methods — structural analysis N87-10896
Demonstration of modal synthesis on an experimental structure and its application to large spacecraft N87-10912
COUPLERS
Analysis of directional coupler signals in an overmoded waveguide system — plasma heating systems
[IPF-85-2] N87-11067
COUPLING CIRCUITS
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946
COUPLINGS
Investigation of the coupling of the Hermes vehicle to the Ariane 5 launcher N87-10937
CRACK ARREST
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
CRACK CLOSURE
Using acoustic waves for the characterization of closed fatigue cracks
[DE86-011404] N87-11228
CRACK INITIATION
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
CRACK PROPAGATION
Design of low alloy steels for thick walled pressure vessels
[DE86-011748] N87-10996
The growth of fatigue cracks in a nickel base single crystal
[PNR-90310] N87-11001
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
Elevated temperature crack growth N87-11214
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
Using acoustic waves for the characterization of closed fatigue cracks
[DE86-011404] N87-11228
The finite element method for calculation of the calibration curves for fracture mechanics specimens of various thickness for the electrical direct current potential crack monitoring systems
[GKSS-86/E/3] N87-11230
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231
CRACKS
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231
CRATERS
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160
CREEP ANALYSIS
Identification of creep mechanisms and quantitative description of stress regimes relevant to design — high temperature plants; wrought alloys
[OEFZS-4352] N87-11232
CREEP PROPERTIES
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
Biaxial constitutive equation development N87-11217
Stress and efficiency studies in EFG
[NASA-CR-179814] N87-11618
CREEP RUPTURE STRENGTH
Advanced composites for lightweight structures N87-10966
Choice of resin when using different carbon fiber types N87-10969
CRITICAL LOADING
Critical joints in large composite aircraft structure
[NASA-CR-3710] N87-10973
CROP GROWTH
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
Ground level radiometric monitoring of rainy season food crops in the Sahel N87-11317
Nutritional diagnosis for plant by field spectroradiometer — sugar beets N87-11328
CROP INVENTORIES
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
CROPS
Description of crop geometry, restricted to parts viewed N87-11273
CROSS FLOW
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
CRUSTAL FRACTURES
Active Tectonics: Part 2: Epeirogenic and intraplate movements N87-11357
CRYOGENIC COOLING
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
CRYOGENIC WIND TUNNELS
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
CRYOPUMPING
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164
CRYOSTATS
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/82351/BO] N87-11654
CRYSTAL GROWTH
Fractal aspects of ceramic synthesis
[DE86-011657] N87-11012
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179836] N87-11619
CRYSTALLIZATION
The crystallization of tough thermoplastic resins in the presence of carbon fibers
[NASA-CR-179810] N87-11006
CRYSTALLOGRAPHY
Crystallography of icosahedral crystals
[DE86-009945] N87-11613
CRYSTALS
Crystallography of icosahedral crystals
[DE86-009945] N87-11613
CUMULUS CLOUDS
A simple parameterization scheme for the determination of the relative coverage by cumulus clouds N87-11393
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441
CURING
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties
[NASA-CR-177058] N87-11007
Measurement of stress distributions in adhesive bonded joints
[AD-A169176] N87-11227
CURVES (GEOMETRY)
ARC-OLOGY via TELL-A-GRAF
[DE86-009698] N87-11517
CYCLONES
Tropical cyclone report, 1985
[AD-A168284] N87-11464
CYLINDRICAL BODIES
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621
CYLINDRICAL SHELLS
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942

D

DAMAGE
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
Remote sensing methods to determine the vitality of vegetation
[LITERATUUROVERZICHT-42] N87-11235
DAMAGE ASSESSMENT
Investigation of spectral reflectance signatures on forest damages using multispectral data N87-11320
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334
DATA ACQUISITION
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10883
Report of the Workshop on Global Large-Scale Precipitation Data Sets for the World Climate Research Programme
[WCP-111] N87-11472
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE-PREPRINT-33] N87-11648
Aeronautics and space report of the President N87-11683
DATA BASE MANAGEMENT SYSTEMS
An assessment of CD ROM (Compact Disk Read Only Memory)
[AD-A169259] N87-11492
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
Experiences with a data analysis management prototype
[DE86-011615] N87-11626
Support for the design and the implementation of the spacecraft performance evaluation services — data base management, ESA
[ESOC/85/1] N87-11632
Making a simple relational database system
[INF-84-18] N87-11633
Minimizing the response time of a query in a distributed data base
[INF-85-26] N87-11634
DATA BASES
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10883
Nickel-hydrogen low-Earth-orbit test program N87-11098
Data bases for isolating the effects of the increaseing carbon dioxide concentration
[DE86-009709] N87-11469
Microcomputer-based local automation model: System planning guidance
[AD-A168136] N87-11630
Translation and optimization of logic queries: The algebraic approach — data bases
[REPT-86-004] N87-11631
Automated Information Retrieval System for Satellites (AIRS). Part 1, Chapter 2: Design phase
[REPT-71.4601] N87-11636
DATA CORRELATION
Machine learning using a higher order correlation network
[DE86-010183] N87-11537
DATA MANAGEMENT
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
DATA PROCESSING
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884
Interactive data analysis
[DFVLR-MITT-86-07] N87-11525
Experiences with a data analysis management prototype
[DE86-011615] N87-11626
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676
DATA PROCESSING EQUIPMENT
Microcomputer-based local automation model: System planning guidance
[AD-A168136] N87-11630
DATA RECORDING
Digital data recording on floppy disks applied for on-board use in helicopters
[DFVLR-MITT-86-10] N87-11149
DATA REDUCTION
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884
Operational evaluation of METEOSAT data N87-11455
Interactive data analysis
[DFVLR-MITT-86-07] N87-11525
DATA TRANSMISSION
Data communication in parallel architectures
[AD-A169302] N87-11531
DECAMETRIC WAVES
Jupiter's decameter and kilometer emissions: Satellite effects and long term periodicities N87-11675
DECIDUOUS TREES
Scattering models for coniferous and deciduous vegetation N87-11283
In-vivo chlorophyll determination of plants by laser-induced fluorometer N87-11287
DECISION MAKING
On actions due to lack of information — human performance
[REPT-85-45] N87-11486
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide
[NASA-CR-178051] N87-11536
The interface with decision makers and some experimental results in interactive multiple objective programming methods
[REPT-85-36] N87-11628
DECISION THEORY
Pairwise-comparison methods using fuzzy numbers on ratio scales with geometric progression — decision theory
[REPT-85-24] N87-11553
DECODING
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Gaussian noise channel N87-11034
A new method for frame synchronization N87-11037
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039
DECOUPLING
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860
DEEP SPACE NETWORK
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025
A prototype DSN X/S-band feed: Model 3 development N87-11027
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11026
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Gaussian noise channel N87-11034
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039
Unattended deep space station tracking station development: Monitor and control technology N87-11042
X-band preamplifier filter N87-11048
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
Deep space network Mark 4A description N87-11051
HEO multimission navigation concept N87-11052
ICE navigation support N87-11053
DEFENSE PROGRAM
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
The strategic defense initiative
[AD-A168147] N87-11644
Aeronautics and space report of the President N87-11683
DEFOLIATION
Spectral measurements of tree defoliation N87-11330
DEFORESTATION
Change of the local climate by deforestation. A numerical simulation experiment N87-11447
DEFORMATION
Strain rate dependence of the deformation behavior of polymers at low temperatures
[KFK-4060] N87-11013
DEGRADATION
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-006703] N87-11480
DELAMINATING
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972
DEPOLARIZATION
Spaceborne SAR depolarisation ambiguities N87-11260
DEPOSITION
Dry deposition parameterization in long range transport models — pollution transport
[KNMI-WR-86-1] N87-11354
Ice accretion dependence on cloud physical parameters N87-11433
DEPOSITS
Turbine airfoil deposition models N87-11191
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192
DESERTS
Conclusions from the migration of Barchans on the dominating wind conditions in desert regions N87-11413
DESIGN ANALYSIS
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations
[NASA-CR-3808] N87-10829
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172494] N87-10859
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle
[NASA-TM-85758] N87-10869
Design of control laws for adaptive signal tracking systems N87-10882
The design analysis and verification of a satellite N87-10916
Safety considerations for fabricating lithium battery packs N87-11079
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080
Aerospace nickel-cadmium cell separator qualifications program N87-11085
NOAA 26.5 Ah LEO characterization test N87-11093
Recent advances in Ni-H2 technology at NASA Lewis Research Center N87-11095
Printed circuit transmission line transitions
[AD-A169291] N87-11110
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164
Development of heat flux sensors in turbine airfoils N87-11186
High temperature stress-strain analysis N87-11209
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481
DEVELOPING NATIONS
Implementation of windmills in Gujarat, India
[ETN-86-97720] N87-11342
DIAGNOSIS
Measurement of subscale climatological processes by diagnosis of scaled budgets N87-11381
DIAMAGNETISM
Diamagnetic effect and anomalous transport in expanding plasma clouds — Active Magnetic Particle Tracer Explorer (AMPTE) satellite experiment simulations
[MPE-PREPRINT-26] N87-11647
DIELECTRIC PROPERTIES
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study
[AD-A169398] N87-10978
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties
[NASA-CR-177058] N87-11007
Microwave dielectric properties of minerals and rocks N87-11239
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621
DIESEL ENGINES
Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991
DIFFERENCE EQUATIONS
A family of Fibonacci-like sequences
[INF-85-10] N87-11570
DIFFERENTIAL EQUATIONS
A note on monoticity of a Rosenbrock method
[CWI-NM-R8606] N87-11551

On the numerical integration of second-order initial value problems with a periodic forcing function
[CWI-NM-R8604] N87-11561
DIFFRACTOMETERS
A survey of recent developments in X-ray diffractometry
[MQAD-TR-910] N87-10963
DIFFUSION COEFFICIENT
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine
[IW-R511] N87-10845
Langevin equations With negative diffusion coefficients. A new approach to quantum optics
[NOTA-INTERNA-862] N87-11599
DIGESTING
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-006703] N87-11480
DIGITAL DATA
Digital data recording on floppy disks applied for on-board use in helicopters
[DFVLR-MITT-86-10] N87-11149
DIGITAL FILTERS
An estimator-predictor approach to PLL loop filter design N87-11033
DIGITAL SIMULATION
Direct numerical simulation of homogeneous strained turbulence N87-11120
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes
[DFVLR-FB-86-10] N87-11136
Model simulations of the coastal experiment PUKK N87-11407
Numerical simulation of the urban climate using a 3-dimensional model N87-11411
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430
Change of the local climate by deforestation. A numerical simulation experiment N87-11447
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458
DIGITAL SYSTEMS
Ulysses: A functional description and simulation software system N87-11045
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer
[NASA-TM-89005] N87-11105
DIGITAL TECHNIQUES
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90295] N87-10867
Digital combination of SAR and (MSS) optical data for identification of spectral signatures — SIR-A N87-11329
DIMENSIONS
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures — vibration effects N87-10887
DIPOLE ANTENNAS
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061
DIRECT CURRENT
Radiofrequency amplifier based on a dc superconducting quantum interference device
[AD-D012353] N87-11109
DIRECTIONAL STABILITY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
DISPLAY DEVICES
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10854
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12489-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12489-VOL-2] N87-11491
DISTRIBUTED PROCESSING
TUMULT: A distributed real-time multi-processor system
[INF-85-3] N87-11496
EOS: A project to investigate the design and construction of real-time distributed embedded operating systems
[NASA-CR-179874] N87-11510
A survey of the Twente University MULTIprocessor (TUMULT) system, a real time multiprocessor system
[INF-85-22] N87-11533
DIVIDERS
Microstrip amplitude-weighted wilkinson power dividers
[AD-A169450] N87-11111
DOPPLER EFFECT
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
DOWNLINKING
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025
DRAG REDUCTION
Changes in the turbulent boundary layer structure associated with net drag reduction by outer layer manipulators N87-10850
DRIFT RATE
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426
DROPS (LIQUIDS)
Study on a drop and bubble unit. Volume 1: Executive study — spaceborne experiments
[ESA-CR(P)-2256] N87-10881
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program
[BO-RP-AI-004] N87-11016
La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October
[ESA-TT-964] N87-11131
DUCTS
Gas flow environmental and heat transfer nonrotating 3D program N87-11223
DUNES
Conclusions from the migration of Barchans on the dominating wind conditions in desert regions N87-11413
DWARF NOVAE
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651
DWARF STARS
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
DYNAMIC LOADS
Current problems in solid dynamics
[DE86-011653] N87-11229
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620
DYNAMIC MODELS
Computer simulation of the dynamics of the near-earth part of the geomagnetic tail
[AD-A169449] N87-11359
Climate models: Their application in the investigation of trace gases and the impact on climate N87-11397
DYNAMIC PROGRAMMING
Experiments on the annotation of large quantities of speech using the ZIP dynamic time-warping algorithm
[RSRE-MEMO-3919] N87-11023
DYNAMIC RESPONSE
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908
Initial results from multiaxes transient testing — flexible spacecraft N87-10917
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
The dynamics of heat transfer in turbulent pipe flow, part 3
[OEFZS-4351] N87-11133
A method for the fast estimation of the behavior of stochastic dynamic systems
[ETN-86-97823] N87-11549
DYNAMIC STABILITY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
DYNAMIC STRUCTURAL ANALYSIS
A study of nodal coupling methods — structural analysis N87-10896
Effective modal parameters and truncation effects in structural dynamics N87-10897
Fluid-structure interaction: Modal synthesis method — spacecraft structures N87-10899
Launcher-payload dynamic interaction N87-10900
Computational methods in elastic periodic structures analyses N87-10901
Verification of the mathematical model of the Ariane 4 payload fairing by means of extended modal survey testing N87-10902
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
Demonstration of modal synthesis on an experimental structure and its application to large spacecraft N87-10912
Analysis/test correlation and update of dynamic mathematical models — spacecraft structures N87-10913
Applying modal survey test results for updating dynamic mathematical models of spacecraft structures N87-10914
A review of time domain modal test methods and applications — space structures N87-10915
Tele-X antenna module structure qualification program N87-10924
Loads analysis for the Galileo spacecraft N87-10926
Critical element concepts for composite structures N87-10930
Dynamics of flexible mechanisms — spacecraft N87-10938
Kinematic analysis of a large deployable truss antenna — spacecraft antenna N87-10941
Stress analysis of Pathfinder-2 models
[NASA-CR-172458] N87-11179
Parallel processors and nonlinear structural dynamics algorithms and software
[NASA-CR-179889] N87-11511
DYNAMIC TESTS
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties
[NASA-CR-177058] N87-11007
DYNAMICAL SYSTEMS
An experimental investigation of dynamic ground effect N87-10833
The structure of orbits in dynamical systems (revised version)
[REPT-85-28] N87-11554
Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom
[NOTA-INTERNA-859] N87-11564
Probabilistic solutions of generalized birth and death equations and application to nonrelativistic electrodynamics
[PREPRINT-483] N87-11625
DYNAMOMETERS
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014

E

EARTH (PLANET)
Computer simulation of the dynamics of the near-earth part of the geomagnetic tail
[AD-A169449] N87-11359
EARTH ALBEDO
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
EARTH ATMOSPHERE
Minor scale weather-watch and microbarograph project experiments 8620, 9415, 9416
[DE86-009641] N87-11466
EARTH OBSERVATIONS (FROM SPACE)
Spaceborne SAR depolarisation ambiguities N87-11260
Imaging spectrometry: Past, present, future N87-11274
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
The CO2 laser imaging spectroscopy for Earth observation N87-11285
The First International Satellite Land-Surface Climatology Project (ISLSCP) Field Experiment (FIFE) N87-11294
EARTH ORBITAL ENVIRONMENTS
Status of advanced propulsion for space based orbital transfer vehicle
[NASA-TM-88848] N87-10959
Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit
[NASA-TM-88865] N87-10960
A space radiation test model study
[AD-A169412] N87-11681

EARTH ORBITS
Voltage-temperature charge verification testing of 34 ampere-hour nickel-cadmium cells N87-11092
NOAA 26.5 Ah LEO characterization test N87-11093
Recent advances in Ni-H2 technology at NASA Lewis Research Center N87-11095
Nickel-hydrogen low-Earth-orbit test program N87-11098

EARTH RADIATION BUDGET EXPERIMENT
Accuracy analysis of satellite experiments for the measurement of the radiation budget N87-11379

EARTH RESOURCES
A scene radiation model based on four-stream radiative transfer theory — multispectral remote sensing N87-11282

EARTH SURFACE
Residential Earth-coupled heat pump demonstration [PB86-212396] N87-11141
Active Tectonics: Part 2: Epeirogenic and intraplate movements N87-11357
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
The energy balances of selected types of surface in the Munich urban area N87-11429

ECOLOGY
Follow-on proposal identifying environmental features for land management decisions [NASA-CR-179703] N87-11236

ECONOMIC ANALYSIS
Economic study for NAVSAT [GTS-84051] N87-11568

EDUCATION
Computer aided education in the choce of studies [REPT-85-29] N87-11528
Making a simple relational database system [INF-84-18] N87-11633

EFFICIENCY
On local and nonlocal measures of efficiency — testing and estimation theory [ISSN-0169-2690] N87-11586

EIGENVALUES
Reconstruction of vegetation spectra from soil plant canopies N87-11268

EINSTEIN EQUATIONS
Vacuum polarization on black hole spacetimes N87-11668

EL NINO
The response of the global atmosphere to the extraordinary El Nino sea surface temperature anomaly in January 1983: Simulation N87-11405
The response of the tropical atmosphere to the extraordinary El Nino sea surface temperature anomaly 1982-1983: Observation N87-11406
Investigation of the aperiodic behavior of the Southern Oscillation using methods of nonlinear systems analysis N87-11422

ELASTIC CYLINDERS
Some calculations based on a mathematical model for fluid flow through a collapsible tube [REPT-85-41] N87-11138

ELASTIC DEFORMATION
Model for prediction of the elastic response of composite materials over wide ranges of concentration [AD-A169399] N87-10979

ELASTIC PROPERTIES
Model for prediction of the elastic response of composite materials over wide ranges of concentration [AD-A169399] N87-10979

ELECTRIC DISCHARGES
Environmentally-induced discharge transient coupling to spacecraft [NASA-CR-174922] N87-10946
Electrostatic discharge effects on satellite electronic devices [MATRA-CMT-138-JPG-078-85] N87-10953
Study of a discharge produced by a standing surface wave — plasma physics [LP-213] N87-11609

ELECTRIC FIELDS
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range [AD-A169083] N87-11059

ELECTRIC POTENTIAL
The finite element method for calculation of the calibration curves for fracture mechanics specimens of various thickness for the electrical direct current potential crack monitoring systems [GKSS-86/E/3] N87-11230

ELECTRICAL GROUNDING
Environmentally-induced discharge transient coupling to spacecraft [NASA-CR-174922] N87-10946

ELECTRICAL MEASUREMENT
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations [AD-A168138] N87-10966

ELECTRICAL PROPERTIES
Electro-rheological fluids. A brief description and typical applications [BAE-BT-13744] N87-11132
Stress and efficiency studies in EFG [NASA-CR-179814] N87-11618

ELECTRICAL RESISTIVITY
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study [AD-A169398] N87-10978
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations [AD-A168138] N87-10966
High temperature static strain gage program N87-11188
Evaluation results of the 700 deg C Chinese strain gages N87-11189
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190

ELECTRO-OPTICS
Wavelength selective demultiplexer tuner [AD-D012264] N87-11106
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296

ELECTROCHEMICAL CORROSION
Corrosion by polyurethane antistatic foams — microelectronic devices [MQAD-R-343] N87-10984
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials [DFVLR-FB-86-16] N87-11003

ELECTROCHEMISTRY
Use of molten salt electrochemical techniques to study and control hydrogen storage in metal hydrides [DE86-011534] N87-11015
Safety considerations for fabricating lithium battery packs N87-11079
Electromechanical study contributing to the formulation of an analog evolutionary model representing nickel-cadmium batteries [REPT-JMH/GB/GR/769-84] N87-11117

ELECTROMAGNETIC ABSORPTION
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366

ELECTROMAGNETIC COMPATIBILITY
Regulations, criteria, and measurement practice for susceptibility criteria — electromagnetic susceptibility [NLR-MP-84089-U] N87-11065

ELECTROMAGNETIC FIELDS
Analysis of the dispersion force between a layered sphere and a cylinder [AD-A169444] N87-11621

ELECTROMAGNETIC INTERFERENCE
Electrostatic discharge effects on satellite electronic devices [MATRA-CMT-138-JPG-078-85] N87-10953
Regulations, criteria, and measurement practice for susceptibility criteria — electromagnetic susceptibility [NLR-MP-84089-U] N87-11065

ELECTROMAGNETIC PULSES
Research Issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985 [AD-A169268] N87-11062

ELECTROMAGNETIC RADIATION
On the radiation emitted by a particle falling into a black hole in the semirelativistic approximation [NOTA-INTERNA-857] N87-11664

ELECTROMAGNETIC SCATTERING
A translation property in rough surface scattering N87-11258

ELECTROMYOGRAPHY
Controlling the temporal structure of limb movements: A response [AD-A169261] N87-11488

ELECTRON ACCELERATORS
Evolution of free-electron laser development [DE86-008748] N87-11158

ELECTRON BEAM WELDING
Study of the status and potential of high energy beam welding in shipyard construction [AD-A169281] N87-11161

ELECTRON CYCLOTRON HEATING
Analysis of directional coupler signals in an overmoded waveguide system — plasma heating systems [IPF-85-2] N87-11067
Activities report of the Institute for Plasma Research [ETN-86-98253] N87-11608

ELECTRON DENSITY (CONCENTRATION)
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma [AD-A168082] N87-11606

ELECTRON EMISSION
Stability of UV optical coatings in hostile excimer laser environments [AD-A169406] N87-11155

ELECTRON IRRADIATION
Stability of UV optical coatings in hostile excimer laser environments [AD-A169406] N87-11155
Effects of backing plates on the electron exposure of thin polymer films [NASA-TM-88995] N87-11589

ELECTRON MICROSCOPY
Stability of multilayers for short-wavelength optics [DE86-012129] N87-11598

ELECTRON RADIATION
The effects of space radiation on a chemically modified graphite-epoxy composite material [NASA-TM-89232] N87-10977

ELECTRON SCATTERING
Effective Landau theory for disordered interacting electron systems: Specific heat behavior [PREPRINT-500] N87-11617

ELECTRON STATES
An alternative model for the density of states in the Quantum Hall Effect [NOTA-INTERNA-858] N87-11624

ELECTRONIC CONTROL
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B [AD-A169381] N87-10655

ELECTRONIC EQUIPMENT
Corrosion by polyurethane antistatic foams — microelectronic devices [MQAD-R-343] N87-10984
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard — spaceborne radar [ESA-CR(P)-2249] N87-11118

ELECTRONIC EQUIPMENT TESTS
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043
Regulations, criteria, and measurement practice for susceptibility criteria — electromagnetic susceptibility [NLR-MP-84089-U] N87-11065
Investigation of optimal complexity of BITE and its effects on reliability, maintainability, monitoring and fault prediction — Built-In Test (BITE) electronic systems [ETN-86-97976] N87-11175

ELECTRONS
Electron transport in integral photoemission X-ray standing wave analysis [USIP-86-03] N87-11614
The dynamically compressed metallic state: Theory [AD-A169174] N87-11620

ELECTROSTATIC CHARGE
Electrostatic discharge effects on satellite electronic devices [MATRA-CMT-138-JPG-078-85] N87-10953

ELEMENTARY PARTICLE INTERACTIONS
Physics and event simulation at HERA with H1 (report of the Working Group of the H1 Collaboration for HERA) [NOTA-INTERNA-854] N87-11582

ELEMENTARY PARTICLES
Light gluinos at the CERN ppbar collector — supersymmetry theory [PREPRINT-470] N87-11585

ELIMINATION
Gaussian elimination on hypercubes [AD-A169293] N87-11514

EMBEDDED COMPUTER SYSTEMS
EOS: A project to investigate the design and construction of real-time distributed embedded operating systems [NASA-CR-179874] N87-11510

EMISSION
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels [NASA-TM-88873] N87-11345

EMISSION SPECTRA
High resolution spectroscopy of RS CVn stars N87-11657

EMISSIVITY
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method — soil emissivity; laser scattering N87-11279

END EFFECTORS
Characterization and control of object acquisition using a robot hand N87-11174

ENERGETIC PARTICLES
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179863] N87-11672
A space radiation test model study
[AD-A169412] N87-11681
ENERGY BUDGETS
The Martian climate and energy balance models with CO2/H2O atmospheres
[NASA-CR-179888] N87-11673
ENERGY CONSERVATION
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864
ENERGY CONVERSION EFFICIENCY
Sodium-sulfur batteries for spacecraft energy storage N87-11074
Develop and test fuel cell powered on site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175118] N87-11344
Develop and test fuel cell powered on site integrated total energy systems: Phase 3: Full-scale power plant development
[NASA-CR-175075] N87-11347
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349
Investigation of high-efficiency silicon concentrator cells
[DE86-011914] N87-11350
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351
ENERGY DISSIPATION
Acoustic radiation and internal dissipation in honeycomb panels N87-10909
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
ENERGY LEVELS
Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353
ENERGY POLICY
Small scale and short term variability of global radiation in the Federal Republic of Germany N87-11440
Multiple objective modeling: Experimental results with interactive methods in the Netherlands
[REPT-85-49] N87-11557
ENERGY STORAGE
The 1985 Goddard Space Flight Center Battery Workshop
[NASA-CP-2434] N87-11072
NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073
Sodium-sulfur batteries for spacecraft energy storage N87-11074
Energy storage systems comparison for the space station N87-11075
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11088
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Investigation of long term storage effects on aerospace nickel-cadmium cell performance N87-11090
A high reliability battery management system N87-11094
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Nickel-hydrogen low-Earth-orbit test program N87-11098
Parametric tests of a 40-Ah bipolar nickel-hydrogen battery N87-11100
ENERGY TECHNOLOGY
Programs of the Office of Energy Research
[DE86-009937] N87-11646
ENERGY TRANSFER
Vertical energy fluxes and meridional heat transport in the North Atlantic Ocean N87-11373
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661
ENGINE DESIGN
Evaluation of heater design concepts for hydrazine decomposition chambers
[ESA-CR(P)-2239] N87-10962
Component specific modeling N87-11207
ENGINE FAILURE
Piloted simulation study of the effects of an automated trim system on flight characteristics of a light twin-engine airplane with one engine inoperative
[NASA-TP-2633] N87-10843
ENGINE MONITORING INSTRUMENTS
Engine performance monitoring for airlines
[PNR-90305] N87-10868
ENGINE PARTS
Automotive Technology Development Program
[DE86-010883] N87-11163
High-temperature constitutive modeling N87-11210
Elevated temperature crack growth N87-11214
ENGINE TESTING LABORATORIES
Aeronautical facilities assessment
[NASA-RP-1146] N87-10876
ENGINE TESTS
PTA test bed aircraft engine inlet model test report, revised
[NASA-CR-174845] N87-10866
ENGINEERING MANAGEMENT
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986
[PB86-206364] N87-11021
Manufacturing planning in machine building from the point of view of management and workshop personnel N87-11503
ENTRAINMENT
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476
ENVIRONMENT EFFECTS
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment
[ISBN-3-88148-226-1] N87-11367
Challenge of detecting climate change induced by increasing carbon dioxide
[DE86-009704] N87-11467
ENVIRONMENT SIMULATION
Feasibility study of a launcher vibration environment simulator N87-10918
ENVIRONMENTAL TESTS
A method of studying the behavior of composite materials in simulated space environments N87-10940
EPOXY MATRIX COMPOSITES
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
EQUATIONS OF MOTION
A fast algorithm for particle simulations
[AD-A169294] N87-11515
EQUATORIAL ATMOSPHERE
Time series analysis and composite analysis of equatorial observations from ships N87-11377
EQUIPMENT SPECIFICATIONS
NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481
EQUIVALENT CIRCUITS
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range
[AD-A168083] N87-11059
Electromechanical study contributing to the formulation of an analog evolutionary model representing nickel-cadmium batteries
[REPT-JMH/GB/GR/769-84] N87-11117
EROSION
Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts
[DE86-011778] N87-11000
ERROR ANALYSIS
Investigation of optimal complexity of BITE and its effects on reliability, maintainability, monitoring and fault prediction — Built-In Test (BITE) electronic systems
[ETN-86-97976] N87-11175
ERROR CORRECTING CODES
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
ERROR DETECTION CODES
Performance analysis of a cascaded coding scheme with interleaved outer code
[NASA-CR-179869] N87-11512
ERS-1 (ESA SATELLITE)
Active microwave instrumentation Traveling Wave Tube (TWT) amplifiers: Electrical modes, phase 2
[AMI/2/18] N87-11115
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Advanced ocean color monitor (OCM) feasibility study, executive summary
[SNIAS-86-CA/LL/O] N87-11477
ESTIMATES
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11389
ESTIMATING
An estimator-predictor approach to PLL loop filter design N87-11033
Cramer-Rao bounds for signal-to-noise ratio and combiner weight estimation N87-11038
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
EULER EQUATIONS OF MOTION
Euler flow solutions for a transonic wind tunnel section
[CWI-NM-R8601] N87-10847
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128
Multigrid approaches to the Euler equations — compressible flow
[CWI-NM-R8602] N87-11140
An efficient method for solving the steady Euler equations
[NASA-TM-87329] N87-11543
EULER-CAUCHY EQUATIONS
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
EUROPE
North Atlantic Oscillation (NAO) in ground pressure and its significance for the Atlantic-European area N87-11374
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375
A simple guidance forecast for 100 stations in Europe as a support for the weather report for holiday countries
[REPT-84-4] N87-11475
EUROPEAN SPACE AGENCY
Composites design handbook for space structure applications. Executive summary
[ESA-CR(P)-2196] N87-10982
Support for the design and the implementation of the spacecraft performance evaluation services — data base management, ESA
[ESOC/85/1] N87-11632
EUROPEAN SPACE PROGRAMS
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2
[ESA-CR(P)-2219] N87-10880
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10893
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program
[BO-RP-AI-004] N87-11016
Advanced ocean color monitor (OCM) feasibility study, executive summary
[SNIAS-86-CA/LL/O] N87-11477
Automated Information Retrieval System for Satellites (AIRS). Part 1, Chapter 2: Design phase
[REPT-71.4601] N87-11636
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning system
[ESA-CR(P)-2213-VOL-1] N87-11638
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning
[ESA-CR(P)-2213-VOL-2] N87-11639
EVALUATION
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies
[KFK-PFT-119] N87-11500
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
EVAPORATION
The evaporation of several types of vegetation and its modeling by a simple inventory climate model N87-11388
EVOLUTION (DEVELOPMENT)
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
EXCHANGING
The carbon exchange between atmosphere and terrestrial biosphere N87-11385

EXCIMER LASERS
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
EXHAUST GASES
Experimental verification of rocket exhaust plumes and impingement effects on spacecraft surfaces
[DFVLR-IB-22-85-A-29] N87-10961
Laser anemometers of hot-section applications N87-11187
EXHAUST SYSTEMS
National Transportation Safety Board safety recommendation N87-10852
EXPERIENCE
Practical experience with the application of CAD/CAM to a medium-size company N87-11502
EXPERIMENT DESIGN
Determining the influence and effects of manufacturing variables on sulfur dioxide cells N87-11077
Physics and event simulation at HERA with H1 (report of the Working Group of the H1 Collaboration for HERA)
[NOTA-INTERNA-854] N87-11582
EXPERT SYSTEMS
Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489
EXPLOSIONS
Minor scale weather-watch and microbarograph project experiments 8620, 9415, 9416
[DE86-009641] N87-11466
EXTENSIONS
Toughness and matching extension in graphs
[AD-A169177] N87-11544
EXTERNAL COMBUSTION ENGINES
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
EXTERNAL STORES
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11126
EXTINCTION
Microwave scattering loss of dry snow N87-11288
EXTRATERRESTRIAL RADIATION
The effects of space radiation on a chemically modified graphite-epoxy composite material
[NASA-TM-89232] N87-10977
A space radiation test model study
[AD-A169412] N87-11681
EXTRAVEHICULAR ACTIVITY
Control of a free-flying robot manipulator system
[NASA-CR-179877] N87-11159
EXTREME ULTRAVIOLET RADIATION
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight
[BMFT-FB-W-85-025] N87-11655
EXTREMELY HIGH FREQUENCIES
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range
[AD-A168083] N87-11059
EYE MOVEMENTS
Research in the area of visual search
[AD-A168923] N87-11483

F

F-16 AIRCRAFT
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172494] N87-10859
FABRICATION
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351
FABRY-PEROT INTERFEROMETERS
Optical flip-flop system
[AD-D012259] N87-11593
FAIL-SAFE SYSTEMS
Orwellian programming in safety-critical systems
[RSRE-MEMO-3924] N87-11499
FAILURE ANALYSIS
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
Choice of resin when using different carbon fiber types N87-10969
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179833] N87-11142
FAILURE MODES
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
FAIRINGS
Verification of the mathematical model of the Ariane 4 payload fairing by means of extended modal survey testing N87-10902
FAR INFRARED RADIATION
Sub-millimetre (far-IR) heterodyne spectrometer assembly — spaceborne platforms
[CD.6500689] N87-10958
Far-infrared spectral studies from the G. P. Kuiper Airborne Observatory
[NASA-CR-179879] N87-11652
FAR ULTRAVIOLET RADIATION
Polynomial grating
[AD-D012313] N87-11594
FARADAY EFFECT
Fiber optic, Faraday rotation current sensor
[DE86-012413] N87-11573
FARM CROPS
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
FAST FOURIER TRANSFORMATIONS
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
FAST NEUTRONS
Measurements performed at the National Physical Laboratory for an international intercomparison of neutron fluence rate measurements for monoenergetic fast neutrons using the 115 sub in(n, gamma reaction
[NPL-RS(EXT)-81] N87-11580
FATIGUE (MATERIALS)
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10893
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
Fatigue and fracture: Overview N87-11183
Oxidation and low cycle fatigue life prediction N87-11215
Life prediction and constitutive models for engine hot section anisotropic materials N87-11218
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231
FATIGUE LIFE
Fatigue life of laser cut metals
[NASA-CR-179501] N87-11158
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
Using acoustic waves for the characterization of closed fatigue cracks
[DE86-011404] N87-11228
FATIGUE TESTS
Fatigue fracture in steel landing gear components
[NLR-MP-85050-U] N87-11233
FAULT TOLERANCE
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507
FEASIBILITY ANALYSIS
Feasibility study of a launcher vibration environment simulator N87-10918
Advanced ocean color monitor (OCM) feasibility study, executive summary
[SNIAS-96-CA/LL/O] N87-11477
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/62351/BO] N87-11654
FEDERAL BUDGETS
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986
[H-REPT-99-829] N87-11641
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643
FEEDBACK CONTROL
Design of control laws for adaptive signal tracking systems N87-10882
Image based visual servo control of a revolute-coordinate (arm and elbow) robot
[RR-286] N87-11169
Computer program TRAMP: Further extensions — linear feedback systems analysis program
[BAE-BT-13621] N87-11520
FERRIC IONS
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987
FERTILIZATION
Reflectance properties of barley for different agronomical treatments N87-11326
FIBER COMPOSITES
The crystallization of tough thermoplastic resins in the presence of carbon fibers
[NASA-CR-179810] N87-11006
FIBER OPTICS
Improving radiation/contamination tests — satellite coating degradation
[CERT-419300/1-DERTS] N87-10954
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 1: Executive summary
[NASA-CR-179479] N87-11056
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 2: Fiber optic technology and long distance networks
[NASA-CR-179480] N87-11057
Development and test of a miniaturized fiber-optic gyroscope
[BMFT-FB-W-85-033] N87-11148
Analog fiber gyro with extended linear range
[2339212320] N87-11152
Fiber optic, Faraday rotation current sensor
[DE86-012413] N87-11573
FIBER ORIENTATION
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
FIBER REINFORCED COMPOSITES
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
FIBONACCI NUMBERS
A family of Fibonacci-like sequences
[INF-85-10] N87-11570
FIELD EFFECT TRANSISTORS
The 20 GHz GaAs monolithic power amplifier module development
[NASA-CR-179830] N87-11104
Varactor tuned X-band FET oscillator
[BAE-BT-14500] N87-11114
FIELD THEORY (ALGEBRA)
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse
[NOTA-INTERNA-855] N87-11623
FIELD THEORY (PHYSICS)
Multifractal wave function at the localization threshold
[PREPRINT-499] N87-11547
Hyperphotons and K meson decays
[PREPRINT-498] N87-11588
Superstrings and geometry of superspace
[DE86-012044] N87-11622
FIGHTER AIRCRAFT
Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90
[NASA-TP-2350] N87-10870
FILM COOLING
Turbine airfoil gas side heat transfer N87-11219
FILTRATION
Optical filtering techniques
[AD-A168084] N87-11596
FINANCE
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986
[H-REPT-99-829] N87-11641
FINITE DIFFERENCE THEORY
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174676] N87-10835
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10968
FINITE ELEMENT METHOD
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading
[NASA-CR-179867] N87-10976

Computational Fluid Dynamics, volume 2 — conference
[VKI-LS-1986-04-VOL-2] N87-11119
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples
[ETN-86-97826] N87-11170
Constitutive modeling for isotropic materials N87-11211
Constitutive modeling of inelastic anisotropic material response N87-11216
The finite element method for calculation of the calibration curves for fracture mechanics specimens of various thickness for the electrical direct current potential crack monitoring systems
[GKSS-86/E/3] N87-11230
Numerical algorithms for finite element computations on concurrent processors
[NASA-CR-179622] N87-11542
A convergence proof of a multigrid method
[REPT-85-39] N87-11556

FIRE PREVENTION
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985

FLAME PROPAGATION
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10988
Flame radiation N87-11204

FLAMES
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992

FLAMMABILITY
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985

FLAPS (CONTROL SURFACES)
Stress analysis of Pathfinder-2 models
[NASA-CR-172458] N87-11179

FLEXIBILITY
On robots with flexible links: Dynamics, control and stability
[REPT-85-34] N87-11171

FLEXIBLE BODIES
Comparison of some partial differential equation models of flexible structures
[TW-270] N87-11559

FLEXIBLE SPACECRAFT
Initial results from multiaxes transient testing — flexible spacecraft N87-10917
Dynamics of flexible mechanisms — spacecraft N87-10938
Proceedings of the 2nd Annual SCOLE Workshop
[NASA-TM-89048] N87-10945
Modern control of large flexible spacecraft, ESA ASTP study
[BL-8208-ISSUE-2] N87-10956
Large flexible space structures: Some simple models
[TW-269] N87-10957

FLIGHT CLOTHING
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

FLIGHT CONTROL
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
Energy management of 3-dimensional minimum-time intercept N87-10858
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

FLIGHT CREWS
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

FLIGHT MANAGEMENT SYSTEMS
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864

FLIGHT OPTIMIZATION
Energy management of 3-dimensional minimum-time intercept N87-10858

FLIGHT PATHS
Energy management of 3-dimensional minimum-time intercept N87-10858

FLIGHT RECORDERS
Digital data recording on floppy disks applied for on-board use in helicopters
[DFVLR-MITT-86-10] N87-11149

FLIGHT SAFETY
Ice accretion dependence on cloud physical parameters N87-11433
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
The influence of weather-active fronts on visual flight conditions N87-11437
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461

FLIGHT SIMULATION
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10863
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864
Low-cost avionics simulation for aircrew training
[AD-A169198] N87-10885

FLIGHT SIMULATORS
Aeronautical facilities assessment
[NASA-RP-1146] N87-10876
Real time debugging software package for flight simulator software system with variable labeled COMMON blocks
[NLR-MP-85013-U] N87-11530

FLIGHT STABILITY TESTS
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830

FLIGHT TEST INSTRUMENTS
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10863

FLIGHT TESTS
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10863
In-flight calibration during PROMESS campaign — radar targets N87-11245
Analysis and calibration of the Dutch scatterometer measurements N87-11246
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight
[BMFT-FB-W-85-025] N87-11655

FLIP-FLOPS
Optical flip-flop system
[AD-D012259] N87-11593

FLOW DISTRIBUTION
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174876] N87-10835
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine
[IW-R511] N87-10845
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow
[NASA-TM-85948] N87-11143
Combustion overview N87-11181
Host turbine heat transfer overview N87-11184
Aerothermal modeling program, phase 2 N87-11200
Lateral jet injection into typical combustor flowfields N87-11203
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224

FLOW EQUATIONS
Euler flow solutions for a transonic wind tunnel section
[CWI-NM-R8601] N87-10847
On the numerical integration of viscoplastic models — high temperature materials
[KFK-4082] N87-11135
Multigrid approaches to the Euler equations — compressible flow
[CWI-NM-R8602] N87-11140

FLOW MEASUREMENT
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242

FLOW RESISTANCE
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11388

FLOW THEORY
A theory of fractal fluids
[KFK-4070] N87-11134
Turbulence theory from a present-day point of view N87-11415
A nonlinear theory of baroclinic instability N87-11418

FLOW VELOCITY
Laser anemometers of hot-section applications N87-11187

FLUENCE
Measurements performed at the National Physical Laboratory for an international intercomparison of neutron fluence rate measurements for monoenergetic fast neutrons using the 115 sub In(n, gamma reaction
[NPL-RS(EXT)-81] N87-11580

FLUID DYNAMICS
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128
A fast algorithm for particle simulations
[AD-A169294] N87-11515

FLUID FILLED SHELLS
Fluid-structure interaction: Modal synthesis method — spacecraft structures N87-10899

FLUID MECHANICS
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645

FLUTTER ANALYSIS
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172494] N87-10859
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860

FLUX DENSITY
Sodium-sulfur batteries for spacecraft energy storage N87-11074

FLY BY WIRE CONTROL
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

FLYING PLATFORMS
Analog fiber gyro with extended linear range
[2339212320] N87-11152

FOG
A two-dimensional numerical model for fog prognosis N87-11387

FOKKER-PLANCK EQUATION
A method for the fast estimation of the behavior of stochastic dynamic systems
[ETN-86-97823] N87-11549

FOLDING STRUCTURES
Development of deployable truss concept for space station N87-10923

FOREST FIRES
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324

FORESTS
Experiments on modeling radar backscatter of forest stands and research on classification N87-11259
Reflectivity contrast of forested slopes with snow-covered ground N87-11271
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Investigation of spectral reflectance signatures on forest damages using multispectral data N87-11320

FORGING
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples
[ETN-86-97826] N87-11170

FORMING TECHNIQUES
Net shape forming: The route to low cost components. The view point of the aerospace industry
[PNR-90306] N87-11020

FOURIER ANALYSIS
Interactive data analysis
[DFVLR-MITT-86-07] N87-11525

FRACTALS
Fractal aspects of ceramic synthesis
[DE86-011657] N87-11012
A theory of fractal fluids
[KFK-4070] N87-11134
Multifractal wave function at the localization threshold
[PREPRINT-499] N87-11547

FRACTURE MECHANICS
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10893
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933

Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995
Strain rate dependence of the deformation behavior of polymers at low temperatures
[KFK-4060] N87-11013
Fatigue and fracture: Overview N87-11183
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
The finite element method for calculation of the calibration curves for fracture mechanics specimens of various thickness for the electrical direct current potential crack monitoring systems
[GKSS-86/E/3] N87-11230

FRACTURE STRENGTH
Strain rate dependence of the deformation behavior of polymers at low temperatures
[KFK-4060] N87-11013

FRANCE
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283

FREE CONVECTION
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441

FREE ELECTRON LASERS
Evolution of free-electron laser development
[DE86-008748] N87-11156

FREE FLOW
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179832] N87-11123

FREQUENCY CONTROL
Analog fiber gyro with extended linear range
[2339212320] N87-11152

FREQUENCY MODULATION
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150

FREQUENCY STABILITY
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025
Analysis of laser frequency stability of heterodyne measurements — interferometry
[NPL-MOM-78] N87-11153

FRESH WATER
Airborne measurements of the spectral reflectance of freshwater ice N87-11280

FRONTAL WAVES
Modeling of mesoscale processes at oceanic fronts N87-11439

FRONTS (METEOROLOGY)
The influence of weather-active fronts on visual flight conditions N87-11437

FROST DAMAGE
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334

FUEL CELL POWER PLANTS
Develop and test fuel cell powered on site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175118] N87-11344
Develop and test fuel cell powered on site integrated total energy sysems: Phase 3: Full-scale power plant development
[NASA-CR-175075] N87-11347

FUEL CELLS
Develop and test fuel cell powered on site integrated total energy sysems: Phase 3: Full-scale power plant development
[NASA-CR-175075] N87-11347

FUEL COMBUSTION
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10988
Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345

FUEL CONSUMPTION
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864

FUEL CONTAMINATION
National Transportation Safety Board safety recommendation N87-10852

FUNCTIONAL ANALYSIS
A survey of functional programming language principles
[NASA-TM-88019] N87-11506

FURLABLE ANTENNAS
Offset unfurlable antenna. Phase 2A: Executive summary — Intelsat, M-Sat
[MBB-R-0200/3089-R] N87-11066

FUSION REACTORS
Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607

FUZZY SETS
Pairwise-comparison methods using fuzzy numbers on ratio scales with geometric progression — decision theory
[REPT-85-24] N87-11553

G

GALACTIC RADIATION
Photometric redshifts and cosmology N87-11658

GALACTIC STRUCTURE
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651

GALILEO SPACECRAFT
Loads analysis for the Galileo spacecraft N87-10926

GALLIUM ALLOYS
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering
[DE86-007857] N87-11612

GALLIUM ARSENIDES
The 20 GHz GaAs monolithic power amplifier module development
[NASA-CR-179830] N87-11104
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351

GAMBIA
Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325

GAMMA RAY BURSTS
Gamma ray astronomy from satellites and balloons
[MPE-PREPRINT-39] N87-11650

GAMMA RAY OBSERVATORY
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939

GAS FLOW
The interaction of a strong stellar wind with a multiphase interstellar medium N87-11667

GAS GIANT PLANETS
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670

GAS MIXTURES
Nucleation in binary supersaturated gas mixtures
[KFK-4036] N87-11581

GAS TEMPERATURE
Furthur development of the dynamic gas temperature measurement system N87-11185

GAS TURBINE ENGINES
Hot section viewing system
[NASA-CR-174773] N87-11144
High temperature static strain gage program N87-11188
Evaluation results of the 700 deg C Chinese strain gages N87-11189
Coating life prediction N87-11194
Aerothermal modeling program, phase 2 N87-11200
NASA dilution jet mixing, phase 3 N87-11202
Elevated temperature crack growth N87-11214
Biaxial constitutive equation development N87-11217
Cost effective single crystals — gas turbine components
[PNR-90319] N87-11615
Development of single crystal alloys for specific engine applications
[PNR-90320] N87-11616

GAS TURBINES
Turbine airfoil deposition models N87-11191
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196
Thermal barrier coating life prediction model development N87-11197
Creep fatigue life prediction for engine hot section materials (isotropic): Two year update N87-11213
Life prediction and constitutive models for engine hot section anisotropic materials N87-11218
Turbine airfoil gas side heat transfer N87-11219
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Effects of very high turbulence on convective heat transfer N87-11222
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349

GAS-GAS INTERACTIONS
The interaction of a strong stellar wind with a multiphase interstellar medium N87-11667

GAS-LIQUID INTERACTIONS
The scaling of two phase flow
[MEAH-64] N87-11139

GAS-METAL INTERACTIONS
Experimental verification of rocket exhaust plumes and impingement effects on spacecraft surfaces
[DFVLR-IB-22-85-A 29] N87-10981

GAS-SOLID INTERFACES
Modeling of the relation between air temperature and surface temperature for the spatial extension of surface parameter analysis models N87-11266

GASEOUS DIFFUSION
Dispersion of accidentally released heavy gases — wind tunnel tests N87-11432

GASEOUS FUELS
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985

GASEOUS SELF-DIFFUSION
On Knudsen flows within thin tubes
[PREPRINT-97] N87-11137

GASOLINE
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014

GATES (CIRCUITS)
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
Optical flip-flop system
[AD-D012259] N87-11593

GAUGE THEORY
Superstrings and geometry of superspace
[DE86-012044] N87-11622

GAUSS EQUATION
Gaussian elimination on hypercubes
[AD-A168293] N87-11514

GEOBOTANY
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325

GEOCHEMISTRY
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338

GEODESY
Demonstration of the fiducial concept using data from the March 1985 GPS field test N87-11055

GEODETIC SATELLITES
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning system
[ESA-CR(P)-2213-VOL-1] N87-11638
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning
[ESA-CR(P)-2213-VOL-2] N87-11639

GEOGRAPHY
Travel report of a visit to the United States from 17 August to 31 August 1985
[ICW-1659] N87-11339

GEOMAGNETIC TAIL
Computer simulation of the dynamics of the near-earth part of the geomagnetic tail
[AD-A169449] N87-11359

GEOMAGNETISM
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data
[PB86-213865] N87-11365
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605

GEOMETRIC RECTIFICATION (IMAGERY)
Landsat D Thematic Mapper image dimensionality reduction and geometric correction accuracy
[NASA-CR-179878] N87-11336

GEOMETRICAL OPTICS
Geometric model simulations of conifer canopy reflectance N87-11269

GEOMETRY
NASA dilution jet mixing, phase 3 N87-11202

GEOPHYSICS
Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea
[PB86-213873] N87-11364
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data
[PB86-213865] N87-11365
GEOSTROPHIC WIND
Determination of the circulation in the North Atlantic Ocean from climatological data N87-11425
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458
GEOSYNCHRONOUS ORBITS
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings
[CERT-4193-VOL-3] N87-10951
GEOTHERMAL ENERGY UTILIZATION
Residential Earth-coupled heat pump demonstration
[PB86-212396] N87-11141
GIACOBINI-ZINNER COMET
ICE navigation support N87-11053
GLASS
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells
[DE86-011563] N87-11112
GLASS FIBERS
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967
GLIDE PATHS
Minimum operational performance standards for airborne ILS glide slope receiving equipment operating within the radio frequency range of 328.6-335.4 MHz
[RTCA/DO-192] N87-10853
GLIDERS
The use of microcomputers for glider weather forecasting N87-11448
GLOBAL POSITIONING SYSTEM
Global positioning system missile test range applications
[DE86-011994] N87-10856
Demonstration of the fiducial concept using data from the March 1985 GPS field test N87-11055
GOES SATELLITES
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
GOES 5
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295
GOES 6
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295
GOVERNMENT PROCUREMENT
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
GOVERNMENT/INDUSTRY RELATIONS
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
GRAMMARS
Abstract grammars based on transductions
[INF-86-13] N87-11522
GRANTS
Graduate engineering research participation in aeronautics
[NASA-CR-179798] N87-10828
GRAPH THEORY
Toughness and matching extension in graphs
[AD-A169177] N87-11544
GRAPHITE-EPOXY COMPOSITES
The effects of space radiation on a chemically modified graphite-epoxy composite material
[NASA-TM-89232] N87-10977
GRASSLANDS
Canopy reflectance modeling in a tropical wooded grassland
[NASA-CR-179895] N87-11237
Spectral measurements for estimation of biomass on limestone grassland N87-11319
GRATINGS (SPECTRA)
Concave diffraction gratings
[NPL-MOM-77] N87-11592
Polynomial grating
[AD-D012313] N87-11594
GRAVITATIONAL COLLAPSE
Neutrinos from gravitational collapse
[DE86-012304] N87-11663
GRAVITATIONAL EFFECTS
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944
GRAZING INCIDENCE
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
GREAT BASIN (US)
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009898] N87-11360
GREENLAND
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
GROUND EFFECT (AERODYNAMICS)
An experimental investigation of dynamic ground effect N87-10833
Advanced method for computing the flow around wings with rear separation and ground effect
[DFVLR-FB-86-17] N87-11017
GROUND STATIONS
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028
Unattended deep space station tracking station development: Monitor and control technology N87-11042
Objectives and first results of the NASA SETI sky survey field tests at Goldstone N87-11054
Demonstration of the fiducial concept using data from the March 1985 GPS field test N87-11055
GROUND SUPPORT SYSTEMS
HEO multimission navigation concept N87-11052
GROUND TRUTH
Determination of land surface parameters by satellite and associated inverse problems N87-11253
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
GROUND WATER
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-006703] N87-11480
GROUND WIND
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456
GROUP DYNAMICS
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572
GROUP VELOCITY
Some considerations of wave propagation
[KNMI-WR-86-2(GO)] N87-11069
GUN PROPELLANTS
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations
[AD-A168136] N87-10986

H

H ALPHA LINE
High resolution spectroscopy of RS CVn stars N87-11657
HABITATS
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-006904] N87-11337
HADRONS
Scaling violation in hadronic interactions and the deep underground flux of cosmic muons — particle collision experiment
[PREPRINT-495] N87-11682
HALL EFFECT
An alternative model for the density of states in the Quantum Hall Effect
[NOTA-INTERNA-858] N87-11624
HAMILTONIAN FUNCTIONS
Transition to stochasticity in Hamiltonian systems: Some numerical results
[PREPRINT-503] N87-11548
HARDNESS
Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts
[DE86-011778] N87-11000
HAZARDS
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944
HEART RATE
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482
HEAT EXCHANGERS
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338
HEAT FLUX
A fast response thermal conductivity gage
[AD-A168185] N87-11146
Development of heat flux sensors in turbine airfoils N87-11186
Flame radiation N87-11204
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169348] N87-11476
HEAT GENERATION
A fast response thermal conductivity gage
[AD-A168185] N87-11146
HEAT MEASUREMENT
Development of heat flux sensors in turbine airfoils N87-11186
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Measurement, calculation, and parameterization of atmospheric heat radiation N87-11390
HEAT PIPES
Residential Earth-coupled heat pump demonstration
[PB86-212396] N87-11141
Simulation of the preliminary General Electric SP-100 space reactor concept using the ATHENA computer code
[DE86-005324] N87-11590
HEAT PUMPS
Residential Earth-coupled heat pump demonstration
[PB86-212396] N87-11141
HEAT RESISTANT ALLOYS
Constitutive modeling for isotropic materials N87-11211
Constitutive modeling for isotropic materials N87-11212
Oxidation and low cycle fatigue life prediction N87-11215
Biaxial constitutive equation development N87-11217
Life prediction and constitutive models for engine hot section anisotropic materials N87-11218
Development of single crystal alloys for specific engine applications
[PNR-90320] N87-11616
HEAT TRANSFER
Effective conductivity of aging polyurethane foam
[DE86-006939] N87-11011
Host turbine heat transfer overview N87-11184
Burner liner thermal/structural load modelling N87-11205
Component specific modeling N87-11207
Turbine airfoil gas side heat transfer N87-11219
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224
Vertical energy fluxes and meridional heat transport in the North Atlantic Ocean N87-11373
Simulation of the preliminary General Electric SP-100 space reactor concept using the ATHENA computer code
[DE86-005324] N87-11590
HEAT TRANSFER COEFFICIENTS
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Effects of very high turbulence on convective heat transfer N87-11222
Coolant passage heat transfer with rotation, a progress report N87-11225
HEATERS
Evaluation of heater design concepts for hydrazine decomposition chambers
[ESA-CR(P)-2239] N87-10962
HELICAL FLOW
Subgrid parameterization in flows with helicity N87-11382
HELICOPTER PERFORMANCE
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation
[NASA-TP-2375] N87-10841
HELICOPTERS
Parametric analysis of a passive cyclic control device for helicopters
[NASA-CR-166606] N87-10962
Digital data recording on floppy disks applied for on-board use in helicopters
[DFVLR-MITT-86-10] N87-11149
Reflectance properties of conifers, measured from a helicopter N87-11321

Signal processing and interpretation using multilevel signal abstractions
[AD-A169166] N87-11513
HELMHOLTZ RESONATORS
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179832] N87-11123
HEMATOPOIETIC SYSTEM
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479
HIGH ENERGY INTERACTIONS
Programs of the Office of Energy Research
[DE86-009937] N87-11646
HIGH FREQUENCIES
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445
HIGH POWER LASERS
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031
HIGH PRESSURE
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670
HIGH REYNOLDS NUMBER
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844
HIGH SPEED PHOTOGRAPHY
Method and apparatus for high speed, sustained recording of infrared laser beam patterns
[AD-D012265] N87-11154
HIGH STRENGTH STEELS
Design of low alloy steels for thick walled pressure vessels
[DE86-011748] N87-10996
Fatigue fracture in steel landing gear components
[NLR-MP-85050-U] N87-11233
HIGH TEMPERATURE
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells
[DE86-011563] N87-11112
High temperature static strain gage program N87-11186
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190
High-temperature constitutive modeling N87-11210
Identification of creep mechanisms and quantitative description of stress regimes relevant to design — high temperature plants; wrought alloys
[OEFZS-4352] N87-11232
HIGH TEMPERATURE RESEARCH
High temperature oxidation of alloys. Oxidation mechanisms and experimental methods
[ETN-86-98071] N87-11002
HIPPARCOS SATELLITE
Structural development of the telescope structure of the HIPPARCOS satellite payload N87-10929
HISTOLOGY
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479
HISTORIES
The discovery of the positron
[PREPRINT-469] N87-11584
HOMOMORPHISMS
The structure of orbits in dynamical systems (revised version)
[REPT-85-28] N87-11554
HONEYCOMB STRUCTURES
Acoustic radiation and internal dissipation in honeycomb panels N87-10909
HORN ANTENNAS
VLA feedhorn for Voyager encounter of Neptune N87-11047
HOT CORROSION
Surface protection N87-11182
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192
Effects of surface chemistry on hot corrosion life N87-11193
Coating life prediction N87-11194
HOT SURFACES
Hot section viewing system
[NASA-CR-174773] N87-11144
HUMAN FACTORS ENGINEERING
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12489-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12489-VOL-2] N87-11491
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
HUMAN PERFORMANCE
THe effects of terrain clutter on observer behaviour during search of complex scenery
[BAE-BT-13535] N87-11484
On actions due to lack of information — human performance
[REPT-85-45] N87-11486
HUMIDITY
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
HURRICANES
Satellite observations of atmospherically determined changes of the ocean surface temperature — hurricanes N87-11427
HYBRID STRUCTURES
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343
HYDRAULIC ANALOGIES
The scaling of two phase flow
[MEAH-64] N87-11139
HYDRAULIC CONTROL
Performance characteristics of a low speed hydraulic motor driving a position control system
[BAE-BT-14978] N87-11168
HYDRAZINE ENGINES
Evaluation of heater design concepts for hydrazine decomposition chambers
[ESA-CR(P)-2239] N87-10962
HYDRODYNAMICS
Thermohydrodynamic analysis for laminar lubricating films
[NASA-TM-88845] N87-11124
Single-pulse laser effects measurements at 248 nm
[DE86-011229] N87-11157
The internal memory of open hydrodynamic systems N87-11414
HYDROGEN
Use of molten salt electrochemical techniques to study and control hydrogen storage in metal hydrides
[DE86-011534] N87-11015
HYDROGEN OXYGEN FUEL CELLS
NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073
HYDROLOGY
Travel report of a visit to the United States from 17 August to 31 August 1985
[ICW-1659] N87-11339
Remote sensing in hydrology — aerial photography
[ICW-1667] N87-11340
HYDROLOGY MODELS
Hydrological behavior pattern of isolated lakes and their role in paleoclimatology N87-11438
HYDROXYL RADICALS
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations
[AD-A168138] N87-10966
HYGRAL PROPERTIES
Performance characteristics of composite materials N87-10935
HYPERNUCLEI
Hyperphotons and K meson decays
[PREPRINT-498] N87-11588
HYPERSONIC SPEED
Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842
HYPERSPACES
Gaussian elimination on hypercubes
[AD-A169293] N87-11514
HYPERVELOCITY IMPACT
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160
HYPERVELOCITY PROJECTILES
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160

I

ICE ENVIRONMENTS
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179681] N87-11671
ICE FORMATION
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
ICE MAPPING
Study of the performances of SEASAT satellite over ice and sea ice
[CNES-CS/MM/82/117/CT/GRGS] N87-10955
ICOSAHEDRONS
Crystallography of icosahedral crystals
[DE86-009945] N87-11613
IGNEOUS ROCKS
Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312
IMAGE CONTRAST
Reflectivity contrast of forested slopes with snow-covered ground N87-11271
IMAGE CORRELATORS
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A168042] N87-11586
Passive stereoscopic rangefinder
[BAE-BT-12300] N87-11600
IMAGE ENHANCEMENT
Landsat D Thematic Mapper image dimensionality reduction and geometric correction accuracy
[NASA-CR-179876] N87-11336
IMAGE FILTERS
Application of the spoke filter to digital IR images — target identification
[BAE-BT-13988] N87-11601
IMAGE RESOLUTION
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
IMAGERY
Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer
[NASA-TM-89005] N87-11105
IMAGING TECHNIQUES
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972
Image based visual servo control of a revolute-coordinate (arm and elbow) robot
[RR-288] N87-11169
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
The CO2 laser imaging spectroscopy for Earth observation N87-11285
IMMUNOLOGY
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479
IMPACT LOADS
The prediction of tool pressures in coining
[WPB-0132] N87-11173
Chemical reaction in shock compression of solids
[DE86-003502] N87-11611
IMPACT TESTS
Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts
[DE86-011778] N87-11000
IMPLICATION
A note on prime terms — Boolean functions
[INF-85-5] N87-11550
INCOMPRESSIBLE FLOW
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121
INCOMPRESSIBLE FLUIDS
Direct numerical simulation of homogeneous strained turbulence N87-11120
INDIA
Implementation of windmills in Gujarat, India
[ETN-86-97720] N87-11342
INDIUM ISOTOPES
Measurements performed at the National Physical Laboratory for an international intercomparison of neutron fluence rate measurements for monoenergetic fast neutrons using the 115 sub In(n, gamma reaction
[NPL-RS(EXT)-81] N87-11580
INDUSTRIAL MANAGEMENT
Engineers: Can they be managed?
[PNR-90307] N87-11627
INERTIAL CONFINEMENT FUSION
Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607
INERTIAL NAVIGATION
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
Development and test of a miniaturized fiber-optic gyroscope
[BMFT-FB-W-85-033] N87-11148

INERTIAL PLATFORMS
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85068-U] N87-10863
INFESTATION
Spectral measurements of tree defoliation N87-11330
INFORMATION MANAGEMENT
Microcomputer-based local automation model: System planning guidance
[AD-A168136] N87-11630
INFORMATION RETRIEVAL
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10883
Minimizing the response time of a query in a distributed data base
[INF-85-26] N87-11634
Automated Information Retrieval System for Satellites (AIRS). Part 1, Chapter 2: Design phase
[REPT-71.4601] N87-11636
INFORMATION SYSTEMS
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10883
A modeling approach to information system development
[INF-85-29] N87-11635
INFORMATION THEORY
On actions due to lack of information — human performance
[REPT-85-45] N87-11486
CONST: A constructive approach to information modeling
[REPT-85-44] N87-11637
INFORMATION TRANSFER
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
INFRARED ASTRONOMY
Far-infrared spectral studies from the G. P. Kuiper Airborne Observatory
[NASA-CR-179879] N87-11652
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/62351/BO] N87-11654
INFRARED IMAGERY
AVHRR data processing for utilization in dynamical oceanography — Landsat radiometry N87-11302
Application of the spoke filter to digital IR images — target identification
[BAE-BT-13966] N87-11601
INFRARED LASERS
Method and apparatus for high speed, sustained recording of infrared laser beam patterns
[AD-D012265] N87-11154
INFRARED RADIATION
Method and apparatus for high speed, sustained recording of infrared laser beam patterns
[AD-D012265] N87-11154
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method — soil emissivity; laser scattering N87-11279
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns
[ESA-CR(P)-2254] N87-11383
INFRARED RADIOMETERS
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295
AVHRR data processing for utilization in dynamical oceanography — Landsat radiometry N87-11302
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313
INFRARED SCANNERS
An infrared searchlight
[FOA-C-30421-E4] N87-11602
INFRARED SPECTRA
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
INFRARED SPECTROMETERS
Sub-millimetre (far-IR) heterodyne spectrometer assembly — spaceborne platforms
[CD.8500689] N87-10958
INFRARED SPECTROSCOPY
Concave diffraction gratings
[NPL-MOM-77] N87-11592
INLET AIRFRAME CONFIGURATIONS
Details of low speed intake test facility at the Warton 2.7m x 2.1m wind tunnel
[BAE-AXM127] N87-10873
Mass and momentum turbulent transport experiments N87-11201
INLET NOZZLES
PTA test bed aircraft engine inlet model test report, revised
[NASA-CR-174845] N87-10866
INLET PRESSURE
Flame radiation N87-11204
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349
INPUT
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle
[NASA-TM-85756] N87-10869
INSTRUMENT LANDING SYSTEMS
Minimum operational performance standards for airborne ILS glide slope receiving equipment operating within the radio frequency range of 328.6-335.4 MHz
[RTCA/DO-192] N87-10853
INTEGERS
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041
A family of Fibonacci-like sequences
[INF-85-10] N87-11570
INTEGRAL TRANSFORMATIONS
Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations
[PREPRINT-497] N87-11546
INTEGRATED CIRCUITS
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044
Ulysses: A functional description and simulation software system N87-11045
Silicon wafer cleaning for integrated circuit fabrication
[RSRE-MEMO-3907] N87-11071
The 20 GHz GaAs monolithic power amplifier module development
[NASA-CR-179830] N87-11104
INTELSAT SATELLITES
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
Offset unfurlable antenna. Phase 2A: Executive summary — Intelsat, M-Set
[MBB-R-0200/3069-R] N87-11066
INTERFACES
Measurement of stress distributions in adhesive bonded joints
[AD-A169176] N87-11227
INTERNAL WAVES
Contribution of internal waves to spectral signatures N87-11331
INTERNATIONAL COOPERATION
The First International Satellite Land-Surface Climatology Project (ISLSCP) Field Experiment (FIFE) N87-11294
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476
INTERNATIONAL SUN EARTH EXPLORER 3
ICE navigation support N87-11053
INTERPLANETARY NAVIGATION
ICE navigation support N87-11053
INTERPOLATION
Grid generation around car configurations above a flat ground plane using transfinite interpolation
[FFA-139] N87-11545
INTERPROCESSOR COMMUNICATION
Verification of two communication protocols by means of process algebra
[CWI-CS-R8606] N87-11064
Guide to sharing personal computer resources via local area networks
[DE86-009665] N87-11532
INTERSTELLAR CHEMISTRY
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665
INTERSTELLAR MATTER
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665
The interaction of a strong stellar wind with a multiphase interstellar medium N87-11667
INTERTROPICAL CONVERGENT ZONES
Diagnostic investigations of the intertropical convergent zone N87-11372
INTRAVENOUS PROCEDURES
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481
INVENTORIES
Model designation of military aerospace vehicles
[PB86-222429] N87-10831
INVENTORY MANAGEMENT
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
INVERSIONS
Determination of land surface parameters by satellite and associated inverse problems N87-11253
INVISCID FLOW
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174676] N87-10835
IO
Types and properties of planetary tori and limit on mass loss from satellites N87-11666
ION CURRENTS
A flooded-etarved design for nickel-cadmium cells N87-11086
ION INJECTION
The current system generated by the PORCUPINE artificial ion beam in the ionospheric background plasma
[MPE-PREPRINT-49] N87-11355
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605
ION IRRADIATION
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
ION SCATTERING
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018
IONIZATION COEFFICIENTS
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
IONOSPHERE
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605
IONOSPHERIC CURRENTS
The current system generated by the PORCUPINE artificial ion beam in the ionospheric background plasma
[MPE-PREPRINT-49] N87-11355
IRON ALLOYS
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998
IRON ORES
Spectral study of rocks and some iron deposits from Eastern China N87-11308
IRRADIANCE
Downward long-wave irradiance at the ocean surface using satellite data N87-11303
IRREVERSIBLE PROCESSES
Description of matter-radiation interactions as nonlinear irreversible processes N87-11420
IRRIGATION
Reflectance properties of barley for different agronomical treatments N87-11326
ISOTHERMS
Stress and efficiency studies in EFG
[NASA-CR-179814] N87-11618
ITERATIVE SOLUTION
Some recent developments in spectral methods
[NASA-CR-178178] N87-11127
On Karmarkar's projective method for linear programming
[REPT-85-23] N87-11527
An iterative solution method for solving f(A)x=b, using cg-information obtained for the symmetric positive definite matrix A
[REPT-85-32] N87-11555

J

JAPANESE SPACECRAFT
Structural concept of Japanese advanced geostationary spacecraft N87-10920
JET ENGINE FUELS
Flame radiation N87-11204
JET ENGINES
Component specific modeling N87-11207
JET FLOW
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
JET MIXING FLOW
NASA dilution jet mixing, phase 3 N87-11202
Lateral jet injection into typical combustor flowfields N87-11203

JET STREAMS (METEOROLOGY)
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461
JETTISONING
Verification of the mathematical model of the Ariane 4 payload fairing by means of extended modal survey testing N87-10902
JOINTS (JUNCTIONS)
Critical joints in large composite aircraft structure [NASA-CR-3710] N87-10973
Critical composite joint subcomponents: Analysis and test results [NASA-CR-3711] N87-10975
On robots with flexible links: Dynamics, control and stability [REPT-85-34] N87-11171
Non-destructive methods of characterising the strength of adhesive-bonded joints [RAE-TM-MAT/STR-1065] N87-11176
Structural behavior of the space shuttle SRM Tang-Clevis joint [NASA-TM-89018] N87-11177
Measurement of stress distributions in adhesive bonded joints [AD-A169176] N87-11227
JUPITER (PLANET)
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere [NASA-CR-179863] N87-11672
Jupiter's decameter and kilometer emissions: Satellite effects and long term periodicities N87-11675
JUPITER SATELLITES
Jupiter's decameter and kilometer emissions: Satellite effects and long term periodicities N87-11675

K

KALMAN FILTERS
A recursive solution for a fading memory filter derived from Kalman filter theory N87-11032
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
KILOMETRIC WAVES
Jupiter's decameter and kilometer emissions: Satellite effects and long term periodicities N87-11675
KINETICS
Improved two-dimensional-kinetics computer program [NASA-CR-179782] N87-11508
KNUDSEN FLOW
On Knudsen flows within thin tubes [PREPRINT-97] N87-11137

L

LABORATORY EQUIPMENT
Study on a drop and bubble unit. Volume 1: Executive study — spaceborne experiments [ESA-CR(P)-2256] N87-10881
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program [BO-RP-AI-004] N87-11016
UV/ozone cleaning of surfaces [AD-A169024] N87-11018
LAKE ICE
Airborne measurements of the spectral reflectance of freshwater ice N87-11280
LAKES
Hydrological behavior pattern of isolated lakes and their role in paleoclimatology N87-11438
LAMINAR FLOW
Heat transfer during laminar flow flame quenching: Effect of fuels [DE86-007490] N87-10988
LAMINAR HEAT TRANSFER
Heat transfer during laminar flow flame quenching: Effect of fuels [DE86-007490] N87-10988
LAMINATES
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Performance characteristics of composite materials N87-10935
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading [NASA-CR-179867] N87-10976
Stability of multilayers for short-wavelength optics [DE86-012129] N87-11598
LAND USE
Follow-on proposal identifying environmental features for land management decisions [NASA-CR-179703] N87-11236
LANDAU-GINZBURG EQUATIONS
Effective Landau theory for disordered interacting electron systems: Specific heat behavior [PREPRINT-500] N87-11617
LANDING GEAR
Fatigue fracture in steel landing gear components [NLR-MP-85050-U] N87-11233
LANDING LOADS
Fatigue fracture in steel landing gear components [NLR-MP-85050-U] N87-11233
LANDSAT SATELLITES
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
AVHRR data processing for utilization in dynamical oceanography — Landsat radiometry N87-11302
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Spectral signature of snow in visible and near-infrared wavelengths N87-11316
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324
Digital combination of SAR and (MSS) optical data for identification of spectral signatures — SIR-A N87-11329
Landsat D Thematic Mapper image dimensionality reduction and geometric correction accuracy [NASA-CR-179876] N87-11336
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data [DE86-006904] N87-11337
LANDSAT 5
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334
LANGEVIN FORMULA
Langevin equations With negative diffusion coefficients. A new approach to quantum optics [NOTA-INTERNA-862] N87-11509
LANGUAGE PROGRAMMING
A survey of functional programming language principles [NASA-TM-89019] N87-11506
LAP JOINTS
Stress analysis of Pathfinder-2 models [NASA-CR-172458] N87-11179
LARGE SPACE STRUCTURES
Equivalent continuum analyses of large space trusses N87-10894
Analysis of long thin-walled tubes — large space structures N87-10895
On a simple vibration control design for large space structure models with uncertain parameters N87-10903
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
Demonstration of modal synthesis on an experimental structure and its application to large spacecraft N87-10912
Initial results from multiaxes transient testing — flexible spacecraft N87-10917
Dynamics of flexible mechanisms — spacecraft N87-10938
Proceedings of the 2nd Annual SCOLE Workshop [NASA-TM-89048] N87-10945
Large flexible space structures: Some simple models [TW-269] N87-10957
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds [AD-A168161] N87-11060
LASER ANEMOMETERS
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow [NASA-TM-85948] N87-11143
Laser anemometers of hot-section applications N87-11187
LASER APPLICATIONS
Processing of laser formed SiC powder [NASA-CR-179857] N87-11009
Research issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985 [AD-A169268] N87-11062
LASER CUTTING
Fatigue life of laser cut metals [NASA-CR-179501] N87-11158
LASER INDUCED FLUORESCENCE
In-vivo chlorophyll determination of plants by laser-induced fluorometer N87-11287
LASER INTERFEROMETRY
Analysis of laser frequency stability of heterodyne measurements — interferometry [NPL-MOM-78] N87-11153
LASER MODES
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031
LASER OUTPUTS
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031
Evolution of free-electron laser development [DE86-006748] N87-11156
Study of the status and potential of high energy beam welding in shipyard construction [AD-A169281] N87-11161
LASER STABILITY
Analysis of laser frequency stability of heterodyne measurements — interferometry [NPL-MOM-78] N87-11153
LASER TARGETS
Single-pulse laser effects measurements at 248 nm [DE86-011229] N87-11157
LASER WELDING
Study of the status and potential of high energy beam welding in shipyard construction [AD-A169281] N87-11161
LATE STARS
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
LATHES
Design and performance of a small precision CNC turning machine [DE86-006032] N87-11165
LAUNCH VEHICLES
Launcher-payload dynamic interaction N87-10900
LAVA
Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327
LEADING EDGE FLAPS
Stress analysis of Pathfinder-2 models [NASA-CR-172458] N87-11179
LEADING EDGE THRUST
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations [NASA-CR-3808] N87-10829
LEARNING MACHINES
Machine learning using a higher order correlation network [DE86-010163] N87-11537
LEAST SQUARES METHOD
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
LEAVES
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267
LIAPUNOV FUNCTIONS
Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom [NOTA-INTERNA-859] N87-11564
LIBRARIES
Microcomputer-based local automation model: System planning guidance [AD-A168136] N87-11630
LICHENS
Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327
LIFE (DURABILITY)
Test results of JPL LiSOCl sub 2 cells N87-11081
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
A flooded-starved design for nickel-cadmium cells N87-11086
An advanced Ni-Cd battery cell design N87-11087
A high reliability battery management system N87-11094
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Turbine Engine Hot Section Technology, 1984 [NASA-CP-2339] N87-11180
Combustion overview N87-11181
Surface protection N87-11182
Fatigue and fracture: Overview N87-11183
Turbine airfoil deposition models N87-11191
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192
Effects of surface chemistry on hot corrosion life N87-11193
Coating life prediction N87-11194

Introduction to life modeling of thermal barrier coatings N87-11195
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196
Thermal barrier coating life prediction model development N87-11197
Thermal barrier coating life prediction model development N87-11198
Thermal barrier coating life prediction model development N87-11199
High temperature stress-strain analysis N87-11209
High-temperature constitutive modeling N87-11210
Constitutive modeling for isotropic materials N87-11212
Creep fatigue life prediction for engine hot section materials (isotropic): Two year update N87-11213
Oxidation and low cycle fatigue life prediction N87-11215
Life prediction and constitutive models for engine hot section anisotropic materials N87-11218
Turbine airfoil gas side heat transfer N87-11219
Coolant passage heat transfer with rotation, a progress report N87-11225

LIFE SCIENCES
USSR Space Life Sciences Digest, issue 8 [NASA-CR-3922(09)] N87-11478
European Science Notes, volume 40, number 7 [AD-A168089] N87-11645

LIFTING ROTORS
Parametric analysis of a passive cyclic control device for helicopters [NASA-CR-166608] N87-10862

LIGHT AIRCRAFT
Piloted simulation study of the effects of an automated trim system on flight characteristics of a light twin-engine airplane with one engine inoperative [NASA-TP-2633] N87-10843
Aircraft noise measurement: The 1.2 metre microphone height saga [PNR-90315] N87-11578

LIGHT CURVE
Disappearance of periodic X-ray minima in AM Her [MPE-PREPRINT-52] N87-11680

LIGHT SCATTERING
Modelisation of the optical scattering behaviour of the vegetation canopies N87-11264

LIGHT SOURCES
Analog fiber gyro with extended linear range [2339212320] N87-11152
News about the visibility of signal lights under the influence of the atmosphere N87-11454

LIMBS (ANATOMY)
Controlling the temporal structure of limb movements: A response [AD-A169261] N87-11488

LINE SPECTRA
A new way of organizing spectral line intensity ratio fluctuations of different elements [KGI-PREPRINT-068] N87-10989
A new method of organizing spectral line intensity ratio fluctuations of auroral emissions [KGI-PREPRINT-069] N87-11362
Molecular clouds associated with young open star clusters N87-11659
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665

LINEAR EQUATIONS
On numerical dispersion by upwind differencing [REPT-85-51] N87-11558

LINEAR FILTERS
Spectral analysis for radar using linear predictive filtering [RSRE-MEMO-3896] N87-11022

LINEAR PREDICTION
Spectral analysis for radar using linear predictive filtering [RSRE-MEMO-3896] N87-11022

LINEAR PROGRAMMING
On Karmarkar's projective method for linear programming [REPT-85-23] N87-11527
An algorithm for rescaling a matrix positive definite [AD-A169257] N87-11589
The interface with decision makers and some experimental results in interactive multiple objective programming methods [REPT-85-36] N87-11628

LINEAR SYSTEMS
Analog fiber gyro with extended linear range [2339212320] N87-11152
Computer program TRAMP: Further extensions — linear feedback systems analysis program [BAE-BT-13621] N87-11520
An algorithm for rescaling a matrix positive definite [AD-A169257] N87-11589

LINEARIZATION
A new method of organizing spectral line intensity ratio fluctuations of nightglow emissions [KGI-PREPRINT-067] N87-11361
A new method of organizing spectral line intensity ratio fluctuations of auroral emissions [KGI-PREPRINT-069] N87-11362

LININGS
Turbine Engine Hot Section Technology, 1984 [NASA-CP-2339] N87-11180
Combustion overview N87-11181
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190
Burner liner thermal/structural load modelling N87-11205
The 3-D inelastic analysis methods for hot section components (base program) N87-11208
High temperature stress-strain analysis N87-11209

LIQUID COOLING
Heat exchangeable liquid injected compressors [ETN-86-97652] N87-11166

LIQUID CRYSTALS
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator [AD-A168042] N87-11595

LIQUID FUELS
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations [AD-A168138] N87-10966

LIQUID-SOLID INTERFACES
The interface between fiber and matrix resin from a chemical point of view N87-10970

LISTS
Model designation of military aerospace vehicles [PB86-222429] N87-10831

LITHIUM SULFUR BATTERIES
The 1985 Goddard Space Flight Center Battery Workshop [NASA-CP-2434] N87-11072
Galileo Li/SO sub 2 battery modules program update N87-11076
Determining the influence and effects of manufacturing variables on sulfur dioxide cells N87-11077
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
Safety considerations for fabricating lithium battery packs N87-11079
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080
Test results of JPL LiSOCl sub 2 cells N87-11081
A 65 Ah rechargeable lithium molybdenum disulfide battery N87-11082
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells [DE86-011563] N87-11112

LITHOLOGY
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah [DE86-009896] N87-11360

LITHOSPHERE
Active Tectonics: Part 2: Epeirogenic and intraplate movements N87-11357

LOADS (FORCES)
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading [NASA-CR-179867] N87-10976

LOGIC DESIGN
Translation and optimization of logic queries: The algebraic approach — data bases [REPT-86-004] N87-11631

LONG TERM EFFECTS
Investigation of long term storage effects on aerospace nickel-cadmium cell performance N87-11090
Nickel hydrogen low Earth orbit life testing N87-11102

LONG WAVE RADIATION
Downward long-wave irradiance at the ocean surface using satellite data N87-11303

LONGITUDINAL CONTROL
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle [NASA-TM-85758] N87-10869

LOW FREQUENCIES
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures — vibration effects N87-10887
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908

LOW SPEED
Performance characteristics of a low speed hydraulic motor driving a position control system [BAE-BT-14976] N87-11168

LOW SPEED WIND TUNNELS
An experimental investigation of dynamic ground effect N87-10833
Details of low speed intake test facility at the Warton 2.7m x 2.1m wind tunnel [BAE-AXM127] N87-10873
Practical evaluation of wall pressure signature correction methods in the 2.7m x 2.1m low speed wind tunnel [BAE-ARG-204] N87-10874
Prop-fan slipstream effects using static simulators: Low speed task, phase 1 [BAE-B59R/R-D/610/13498] N87-10875

LOW TEMPERATURE
Strain rate dependence of the deformation behavior of polymers at low temperatures [KFK-4060] N87-11013

LUBRICANTS
Thermohydrodynamic analysis for laminar lubricating films [NASA-TM-88845] N87-11124

M

M STARS
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656

MACHINE ORIENTED LANGUAGES
A survey of functional programming language principles [NASA-TM-89019] N87-11506

MACHINE TOOLS
Development of precision turning capabilities at Lawrence Livermore National Laboratory [DE86-011884] N87-11162
The prediction of tool pressures in coining [WPB-0132] N87-11173

MACHINING
Development of precision turning capabilities at Lawrence Livermore National Laboratory [DE86-011884] N87-11162
Design and performance of a small precision CNC turning machine [DE86-008032] N87-11165

MAGMA
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program [DE86-009558] N87-11338

MAGNESIUM ALLOYS
Current Awareness Bulletin: Metals and Ceramics [CAB-160] N87-10995

MAGNETIC DISKS
Digital data recording on floppy disks applied for on-board use in helicopters [DFVLR-MITT-86-10] N87-11149

MAGNETIC EFFECTS
Types and properties of planetary tori and limit on mass loss from satellites N87-11666

MAGNETIC FIELDS
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data [PB86-213865] N87-11365
Fiber optic, Faraday rotation current sensor [DE86-012413] N87-11573
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering [DE86-007857] N87-11612
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985 [AD-A168046] N87-11677

MAGNETIC MONOPOLES
The external muon detector for ICARUS [NOTA-INTERNA-863] N87-11583

MAGNETIC STORMS
Discovery of energetic molecular ions (NO^+ and $O2^+$) in the storm time ring current — magnetic storms [MPE-PREPRINT-53] N87-11356

MAGNETOHYDRODYNAMIC FLOW
Diamagnetic effect and anomalous transport in expanding plasma clouds — Active Magnetic Particle Tracer Explorer (AMPTE) satellite experiment simulations [MPE-PREPRINT-26] N87-11647

MAGNETOSPHERE
Computer simulation of the dynamics of the near-earth part of the geomagnetic tail [AD-A169449] N87-11359
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere [NASA-CR-179863] N87-11672

A space radiation test model study
[AD-A169412] N87-11681
MAINTAINABILITY
Investigation of optimal complexity of BITE and its effects on reliability, maintainability, monitoring and fault prediction — Built-In Test (BITE) electronic systems
[ETN-86-97976] N87-11175
MALES
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482
MALI
Ground level radiometric monitoring of rainy season food crops in the Sahel N87-11317
MAN ENVIRONMENT INTERACTIONS
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
Climate models: Their application in the investigation of trace gases and the impact on climate N87-11397
MANAGEMENT INFORMATION SYSTEMS
Introduction to the Tools for User-Friendly Business Applications (TUBA) system
[INF-85-24] N87-11526
MANIFOLDS (MATHEMATICS)
Quantum effects in non-maximally symmetric spaces N87-11669
MANIPULATORS
Control of a free-flying robot manipulator system
[NASA-CR-179877] N87-11159
Computer aided design of robot manipulators and their operations
[NLR-MP-85012-U] N87-11172
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
MANNED SPACE FLIGHT
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481
Aeronautics and space report of the President N87-11683
MANUFACTURING
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
MANY BODY PROBLEM
A fast algorithm for particle simulations
[AD-A169294] N87-11515
MAPPING
Follow-on proposal identifying environmental features for land management decisions
[NASA-CR-179703] N87-11236
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-006904] N87-11337
Research in the area of visual search
[AD-A168923] N87-11483
Aeronautics and space report of the President N87-11683
MAPS
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677
MARINE BIOLOGY
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476
MARINE ENVIRONMENTS
Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11264
MARINE METEOROLOGY
Sea wind fluctuations analysis N87-11249
MARKET RESEARCH
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning system
[ESA-CR(P)-2213-VOL-1] N87-11638
Solid Earth satellite: Market, cost and benefits study — POPSAT precise positioning
[ESA-CR(P)-2213-VOL-2] N87-11639
MARKOV CHAINS
A method for the fast estimation of the behavior of stochastic dynamic systems
[ETN-86-97823] N87-11549
MARS ATMOSPHERE
The Martian climate and energy balance models with CO2/H2O atmospheres
[NASA-CR-179868] N87-11673
MASERS
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
MASS
Controlling the temporal structure of limb movements: A response
[AD-A169261] N87-11488
MASS FLOW RATE
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
MASS TRANSFER
Single-pulse laser effects measurements at 248 nm
[DE86-011229] N87-11157
Mass and momentum turbulent transport experiments N87-11201
MATERIAL ABSORPTION
Thermodynamic aspects of the absorption of gas in droplets N87-11421
MATHEMATICAL LOGIC
Abstract grammars based on transductions
[INF-85-13] N87-11522
MATHEMATICAL MODELS
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10883
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
Analysis/test correlation and update of dynamic mathematical models — spacecraft structures N87-10913
Applying modal survey test results for updating dynamic mathematical models of spacecraft structures N87-10914
Calculating and predicting the properties of materials
[DE86-011557] N87-10964
Model for prediction of the elastic response of composite materials over wide ranges of concentration
[AD-A169399] N87-10979
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986
[PB86-206364] N87-11021
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
Some calculations based on a mathematical model for fluid flow through a collapsible tube
[REPT-85-41] N87-11136
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180
Combustion overview N87-11181
Fatigue and fracture: Overview N87-11183
Furthur development of the dynamic gas temperature measurement system N87-11185
Thermal barrier coating life prediction model development N87-11197
Thermal barrier coating life prediction model development N87-11198
Thermal barrier coating life prediction model development N87-11199
Aerothermal modeling program, phase 2 N87-11200
The 3D inelastic analysis methods for hot section components N87-11206
Component specific modeling N87-11207
The 3-D inelastic analysis methods for hot section components (base program) N87-11208
High-temperature constitutive modeling N87-11210
Constitutive modeling for isotropic materials N87-11211
Constitutive modeling for isotropic materials N87-11212
Elevated temperature crack growth N87-11214
Constitutive modeling of inelastic anisotropic material response N87-11216
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
Current problems in solid dynamics
[DE86-011653] N87-11229
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Microwave modeling of snow and soil N87-11255
A scene radiation model based on four-stream radiative transfer theory — multispectral remote sensing N87-11262
Scattering models for coniferous and deciduous vegetation N87-11263
Modelisation of the optical scattering behaviour of the vegetation canopies N87-11264
Modeling of the relation between air temperature and surface temperature for the spatial extension of surface parameter analysis models N87-11266
Geometric model simulations of conifer canopy reflectance N87-11269
Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325
Climate models with stochastic excitation N87-11396
Test of a simple cloud model with precipitation N87-11452
Multiple objective modeling: Experimental results with interactive methods in the Netherlands
[REPT-85-49] N87-11557
Comparison of some partial differential equation models of flexible structures
[TW-270] N87-11559
Crystallography of icosahedral crystals
[DE86-009945] N87-11613
CONST: A constructive approach to information modeling
[REPT-85-44] N87-11637
MATRICES (MATHEMATICS)
An algorithm for rescaling a matrix positive definite
[AD-A169257] N87-11589
MATRIX METHODS
A study of nodal coupling methods — structural analysis N87-10896
Computational methods in elastic periodic structures analyses N87-10901
Analysis/test correlation and update of dynamic mathematical models — spacecraft structures N87-10913
MEASURING INSTRUMENTS
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986
[PB86-206364] N87-11021
MECHANICAL ENGINEERING
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
MECHANICAL PROPERTIES
Calculating and predicting the properties of materials
[DE86-011557] N87-10964
Surface protection N87-11182
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620
MELTS (CRYSTAL GROWTH)
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179836] N87-11619
MEMORY (COMPUTERS)
Multiprocessing the Sieve of Eratosthenes
[NASA-CR-178131] N87-11509
MERIDIONAL FLOW
Vertical energy fluxes and meridional heat transport in the North Atlantic Ocean N87-11373
MESONS
Hyperphotons and K meson decays
[PREPRINT-498] N87-11588
MESOSCALE PHENOMENA
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11386
The significance of initialization for the unsteady simulation of mesoscale flows N87-11408
The dynamic basic structure of the Geesthacht (West Germany) mesoscale model N87-11409
A mesoscale climate model for the investigation of atmospheric flows under the influence of orography, turbulence, and cloud physics N87-11410
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436
Modeling of mesoscale processes at oceanic fronts N87-11439
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456
Analysis of mesoscale temperature and turbidity field — ocean surface layer N87-11457
METABOLISM
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A168064] N87-11479
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482
METAL CUTTING
Design and performance of a small precision CNC turning machine
[DE86-008032] N87-11165
METAL FATIGUE
The growth of fatigue cracks in a nickel base single crystal
[PNR-90310] N87-11001
Fatigue fracture in steel landing gear components
[NLR-MP-85050-U] N87-11233
METAL HYDRIDES
Use of molten salt electrochemical techniques to study and control hydrogen storage in metal hydrides
[DE86-011534] N87-11015

METAL SHELLS
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939
METAL SURFACES
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
METALS
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987
Fatigue life of laser cut metals
[NASA-CR-179501] N87-11158
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-008703] N87-11480
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620
METEOROID HAZARDS
Protection of spacecraft from meteoroids and orbital debris
[DE86-009996] N87-10947
METEOROID PROTECTION
Protection of spacecraft from meteoroids and orbital debris
[DE86-009996] N87-10947
METEOROIDS
Protection of spacecraft from meteoroids and orbital debris
[DE86-009996] N87-10947
METEOROLOGICAL CHARTS
A simple guidance forecast for 100 stations in Europe as a support for the weather report for holiday countries
[REPT-84-4] N87-11475
METEOROLOGICAL PARAMETERS
Time series analysis and composite analysis of equatorial observations from ships N87-11377
Determination of the circulation in the North Atlantic Ocean from climatological data N87-11425
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435
METEOROLOGICAL SERVICES
Climatological data of the Federal Republic of Germany N87-11443
Activities report in meteorology
[AR-84/85] N87-11473
METEOROLOGY
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment
[ISBN-3-88148-226-1] N87-11367
The internal memory of open hydrodynamic systems N87-11414
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
Activities report in meteorology
[AR-84/85] N87-11473
MEPRO: A volume of IMIS procedures for the use of the operational-meteorological practice
[REPT-84-2] N87-11474
METEOSAT SATELLITE
Operational evaluation of METEOSAT data N87-11455
METRIC SPACE
On restrictions of projections along separable metric spaces
[REPT-85-42] N87-11571
MICROCLIMATOLOGY
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324
MICROCOMPUTERS
The use of microcomputers for glider weather forecasting N87-11448
Microcomputer-based local automation model: System planning guidance
[AD-A168136] N87-11630
MICROCRACKS
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
MICROELECTRONICS
Corrosion by polyurethane antistatic foams — microelectronic devices
[MQAD-R-343] N87-10984
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044
Microwaves and microelectronics
[FOA-C-30426-E] N87-11118
MICROMETEOROLOGY
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431
MICROORGANISMS
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-008703] N87-11480
MICROPHONES
Aircraft noise measurement: The 1.2 metre microphone height saga
[PNR-90315] N87-11578
MICROPROCESSORS
A high reliability battery management system N87-11094
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676
MICROSTRIP TRANSMISSION LINES
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061
MICROSTRUCTURE
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
MICROWAVE AMPLIFIERS
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
MICROWAVE CIRCUITS
Microwaves and microelectronics
[FOA-C-30426-E] N87-11118
MICROWAVE EMISSION
Microwave modeling of snow and soil N87-11255
MICROWAVE EQUIPMENT
Microstrip amplitude-weighted wilkinson power dividers
[AD-A169450] N87-11111
Snow studies: Study journey to Switzerland, January 1986
[FOA-C-30419-E1,E3] N87-11341
MICROWAVE FILTERS
X-band preamplifier filter N87-11048
MICROWAVE OSCILLATORS
Varactor tuned X-band FET oscillator
[BAE-BT-14500] N87-11114
MICROWAVE RADIOMETERS
Absolute calibration of remote sensing instruments N87-11292
MICROWAVE SCATTERING
Microwave modeling of snow and soil N87-11255
Microwave scattering loss of dry snow N87-11288
Measurements of microwave backscatter from trees N87-11318
MICROWAVE SENSORS
Active microwave instrumentation Traveling Wave Tube (TWT) amplifiers: Electrical modes, phase 2
[AMI/2/18] N87-11115
Microwave sensing of atmospheric water using the future AMSU system N87-11307
MICROWAVE SPECTRA
Can microwave signatures be used to retrieve the water equivalent of a dry snow pack? N87-11286
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
Calibrated microwave signature measurements of soil and wheat N87-11299
MICROWAVES
Study of a discharge produced by a standing surface wave — plasma physics
[LP-213] N87-11609
MILITARY OPERATIONS
The strategic defense initiative
[AD-A168147] N87-11644
MILITARY TECHNOLOGY
Determining the influence and effects of manufacturing variables on sulfur dioxide cells N87-11077
MILLIMETER WAVES
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060
Components for transmission of very high power mm waves (200 kW at 28, 70 and 140 GHz) in overmoded circular waveguides — plasmaguides
[IPF-86-2] N87-11068
MINERAL DEPOSITS
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323
Spectral features of rocks and minerals from Beiyunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333
MINERAL EXPLORATION
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
MINERALOGY
Radiometric data characterize quantization of soil forming minerals N87-11281
Spectral study of rocks and some iron deposits from Eastern China N87-11306
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
MINERALS
Radiometric data characterize quantization of soil forming minerals N87-11281
Microwave dielectric properties of minerals and rocks N87-11289
MINIATURIZATION
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
MIRRORS
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031
MISSILE LAUNCHERS
Performance characteristics of a low speed hydraulic motor driving a position control system
[BAE-BT-14978] N87-11168
MISSILE TESTS
Global positioning system missile test range applications
[DE86-011994] N87-10856
MISSILE TRACKING
Global positioning system missile test range applications
[DE86-011994] N87-10856
MOBILE COMMUNICATION SYSTEMS
Land Mobile Radio/UHF Television Technical Advisory Committee final report in the matter of further sharing of the UHF television band by private land mobile radio services
[PB86-206562] N87-11070
MODAL RESPONSE
Effective modal parameters and truncation effects in structural dynamics N87-10897
Fluid-structure interaction: Modal synthesis method — spacecraft structures N87-10899
The effect of the non-uniform stress distribution in the blankets of single and twin boom solar array panels upon their modal characteristics N87-10904
Experience on the Olympus modal survey test N87-10919
MODELS
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861
Electromechanical study contributing to the formulation of an analog evolutionary model representing nickel-cadmium batteries
[REPT-JMH/GB/GR/769-84] N87-11117
Canopy reflectance modeling in a tropical wooded grassland
[NASA-CR-179895] N87-11237
Controlling the temporal structure of limb movements: A response
[AD-A169261] N87-11488
MODULARITY
Transient external loads or interface forces reconstructed from structural response measurements — modular spacecraft N87-10910
MODULATORS
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
MODULES
Lightweight, direct-radiating nickel hydrogen batteries N87-11096
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343
MOLECULAR BIOLOGY
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645
MOLECULAR CLOUDS
Molecular clouds associated with young open star clusters N87-11659
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665
MOLECULAR INTERACTIONS
A fast algorithm for particle simulations
[AD-A169294] N87-11515
MOLECULAR IONS
Discovery of energetic molecular ions (NO+ and O2+) in the storm time ring current — magnetic storms
[MPE-PREPRINT-53] N87-11356
MOLECULES
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572

Molecular dynamics simulation of rigid molecules
[PREPRINT-494] N87-11587

MOLLUSKS
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572

MOLTEN SALTS
Use of molten salt electrochemical techniques to study and control hydrogen storage in metal hydrides
[DE86-011534] N87-11015

MOLYBDENUM ALLOYS
Comparison of the effects of alloyed molybdenum and aqueous molybdate on the pitting resistance of iron-chromium alloys
[DE86-011918] N87-10997

MOMENTUM THEORY
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400

MOMENTUM TRANSFER
Mass and momentum turbulent transport experiments N87-11201

MONOTONE FUNCTIONS
A note on monoticity of a Rosenbrock method
[CWI-NM-R8606] N87-11551

MOUNTAINS
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400

MULTIPLEXING
Wavelength selective demultiplexer tuner
[AD-D012264] N87-11106
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/62351/BO] N87-11654

MULTIPLICATION
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041

MULTIPLIERS
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041

MULTIPROCESSING (COMPUTERS)
TUMULT: A distributed real-time multi-processor system
[INF-85-3] N87-11496
Multiprocessing the Sieve of Eratosthenes
[NASA-CR-178131] N87-11509
A survey of the Twente University MULTIprocessor (TUMULT) system, a real time multiprocessor system
[INF-85-22] N87-11533

MULTISPECTRAL BAND SCANNERS
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11298
Characterising vegetated surfaces with airborne MSS data — Multispectral Scanner (MSS) N87-11315
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-008904] N87-11337

MULTISPECTRAL PHOTOGRAPHY
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
Estimation of atmospheric corrections from multiple aircraft imagery N87-11306
Investigation of spectral reflectance signatures on forest damages using multispectral data N87-11320
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323
Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327
Digital combination of SAR and (MSS) optical data for identification of spectral signatures — SIR-A N87-11329

MULTISPECTRAL RADAR
A scene radiation model based on four-stream radiative transfer theory — multispectral remote sensing N87-11262

MULTIVARIATE STATISTICAL ANALYSIS
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375

MUONS
The external muon detector for ICARUS
[NOTA-INTERNA-863] N87-11583

N

NAMING
The use of values without names in a programming support environment — Flex programming support environment
[RSRE-MEMO-3901] N87-11498

NASA PROGRAMS
Graduate engineering research participation in aeronautics
[NASA-CR-179798] N87-10828
Spacecraft load, design and test philosophies N87-10922
Development of deployable truss concept for space station N87-10923
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986
[H-REPT-99-829] N87-11641
NASA Space Program
[S-HRG-99-691] N87-11642
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643

NASA SPACE PROGRAMS
Aeronautics and space report of the President N87-11683

NATURAL SATELLITES
Types and properties of planetary tori and limit on mass loss from satellites N87-11666

NAVIER-STOKES EQUATION
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
Computational Fluid Dynamics, volume 2 — conference
[VKI-LS-1986-04-VOL-2] N87-11119
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
The solution of the parabolized Navier-Stokes equations
[CFD/86/2] N87-11130
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220

NAVIGATION INSTRUMENTS
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10854

NAVSTAR SATELLITES
Economic study for NAVSAT
[GTS-84051] N87-11568

NEAR INFRARED RADIATION
Relation between soil moisture tension and spectral reflectance of different soil in visible and near-infrared range N87-11314
Spectral signature of snow in visible and near-infrared wavelengths N87-11316

NEBULAE
Types and properties of planetary tori and limit on mass loss from satellites N87-11666

NETHERLANDS
Aviation statistics, 1984
[ISBN-90-357-0386-3] N87-10851
Multiple objective modeling: Experimental results with interactive methods in the Netherlands
[REPT-85-49] N87-11557

NETWORK ANALYSIS
Machine learning using a higher order correlation network
[DE86-010183] N87-11537

NEUTRINOS
Neutrinos from gravitational collapse
[DE86-012304] N87-11663

NEUTRON FLUX DENSITY
Measurements performed at the National Physical Laboratory for an international intercomparison of neutron fluence rate measurements for monoenergetic fast neutrons using the 115 sub In(n, gamma reaction
[NPL-RS(EXT)-81] N87-11580

NEUTRON STARS
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661
Bimodal quasi-oscillatory and spectral behavior in Sco X-1
[MPE-PREPRINT-45] N87-11662

NEWTON-RAPHSON METHOD
A note on monoticity of a Rosenbrock method
[CWI-NM-R8606] N87-11551

NICKEL ALLOYS
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998
The growth of fatigue cracks in a nickel base single crystal
[PNR-90310] N87-11001
High temperature oxidation of alloys. Oxidation mechanisms and experimental methods
[ETN-86-98071] N87-11002
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
High temperature static strain gage program N87-11188
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338

NICKEL CADMIUM BATTERIES
The 1985 Goddard Space Flight Center Battery Workshop
[NASA-CP-2434] N87-11072
Qualification testing of general electric 50 Ah nickel-cadmium cells with new separator and new positive plate processing N87-11084
Aerospace nickel-cadmium cell separator qualifications program N87-11085
A flooded-starved design for nickel-cadmium cells N87-11086
An advanced Ni-Cd battery cell design N87-11087
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11088
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Investigation of long term storage effects on aerospace nickel-cadmium cell performance N87-11090
Satellite battery testing status N87-11091
Voltage-temperature charge verification testing of 34 ampere-hour nickel-cadmium cells N87-11092
NOAA 26.5 Ah LEO characterization test N87-11093
A high reliability battery management system N87-11094
Electromechanical study contributing to the formulation of an analog evolutionary model representing nickel-cadmium batteries
[REPT-JMH/GB/GR/769-84] N87-11117

NICKEL HYDROGEN BATTERIES
The 1985 Goddard Space Flight Center Battery Workshop
[NASA-CP-2434] N87-11072
Recent advances in Ni-H2 technology at NASA Lewis Research Center N87-11095
Lightweight, direct-radiating nickel hydrogen batteries N87-11096
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Nickel-hydrogen low-Earth-orbit test program N87-11098
Impact of shuttle environment on prelaunch handling of nickel-hydrogen batteries N87-11099
Parametric tests of a 40-Ah bipolar nickel-hydrogen battery N87-11100
Nickel-hydrogen batteries from Intelsat 5 to space station N87-11101
Nickel hydrogen low Earth orbit life testing N87-11102
The 4.5 inch diameter IPV Ni-H2 cell development program N87-11103

NIGHTGLOW
A new method of organizing spectral line intensity ratio fluctuations of nightglow emissions
[KGI-PREPRINT-067] N87-11361

NIMBUS 7 SATELLITE
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335

NITROGEN COMPOUNDS
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345

NITROGEN IONS
Discovery of energetic molecular ions (NO+ and O2+) in the storm time ring current — magnetic storms
[MPE-PREPRINT-53] N87-11356

NOCTURNAL VARIATIONS
Anemothermographic remote sensing using airborne sensors: A new method of micrometeorological cartography N87-11291

NOISE MEASUREMENT
Aircraft noise measurement: The 1.2 metre microphone height saga
[PNR-90315] N87-11578
NOISE PREDICTION (AIRCRAFT)
Propeller aircraft interior noise model utilization study and validation
[NASA-CR-172428] N87-11576
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579
NOISE REDUCTION
An experimental investigation of the interior noise control effects of propeller synchrophasing
[NASA-CR-178185] N87-11577
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579
NONDESTRUCTIVE TESTS
Non-destructive methods of characterizing the strength of adhesive-bonded joints
[RAE-TM-MAT/STR-1065] N87-11176
NONEQUILIBRIUM IONIZATION
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
NONEQUILIBRIUM PLASMAS
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
NONEQUILIBRIUM THERMODYNAMICS
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples
[ETN-86-97826] N87-11170
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
Thermodynamic aspects of the absorption of gas in droplets N87-11421
NONLINEAR EQUATIONS
A proposal for a new software reliability model and its preliminary assessment
[REPT-86-001] N87-11519
NONLINEAR EVOLUTION EQUATIONS
Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations
[PREPRINT-497] N87-11546
NONLINEAR OPTICS
Langevin equations With negative diffusion coefficients. A new approach to quantum optics
[NOTA-INTERNA-862] N87-11599
NONLINEAR SYSTEMS
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417
A nonlinear theory of baroclinic instability N87-11418
Description of matter-radiation interactions as nonlinear irreversible processes N87-11420
Thermodynamic aspects of the absorption of gas in droplets N87-11421
Investigation of the aperiodic behavior of the Southern Oscillation using methods of nonlinear systems analysis N87-11422
NONLINEARITY
A methodology for designing robust multivariable nonlinear control systems
[NASA-CR-179891] N87-11567
NORWAY
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445
NOZZLE FLOW
Static internal performance of single-expansion-ramp nozzles with thrust-vectoring capability up to 60 deg
[NASA-TP-2364] N87-10839
NUCLEAR EXPLOSIONS
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620
NUCLEAR FUSION
Programs of the Office of Energy Research
[DE86-009937] N87-11646
NUCLEAR PHYSICS
Electroweak interactions
[PREPRINT-482] N87-11586
Programs of the Office of Energy Research
[DE86-009937] N87-11646
NUCLEAR RESEARCH AND TEST REACTORS
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591
NUCLEATION
Nucleation in binary supersaturated gas mixtures
[KFK-4036] N87-11581
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179636] N87-11619
NULL HYPOTHESIS
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150
NULL ZONES
Optical filtering techniques
[AD-A168084] N87-11596
NUMERICAL ANALYSIS
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations
[NASA-CR-3808] N87-10829
Finite length effects in Taylor-Couette flow
[NASA-CR-178175] N87-11125
Current problems in solid dynamics
[DE86-011653] N87-11229
NUMERICAL CONTROL
A high reliability battery management system N87-11094
Design and performance of a small precision CNC turning machine
[DE86-006032] N87-11165
NUMERICAL INTEGRATION
On the numerical integration of viscoplastic models — high temperature materials
[KFK-4082] N87-11135
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516
Linear stability of the hopscotch scheme
[CWI-NM-R8603] N87-11560
On the numerical integration of second-order initial value problems with a periodic forcing function
[CWI-NM-R8604] N87-11561
NUMERICAL STABILITY
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516
On numerical dispersion by upwind differencing
[REPT-85-51] N87-11558
Linear stability of the hopscotch scheme
[CWI-NM-R8603] N87-11560
The order of B-convergence of algebraically stable Runge-Kutta methods
[CWI-NM-R8607] N87-11562
NUMERICAL WEATHER FORECASTING
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11386
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436
Operational evaluation of METEOSAT data N87-11455
A simple guidance forecast for 100 stations in Europe as a support for the weather report for holiday countries
[REPT-84-4] N87-11475
NUTRITION
Nutritional diagnosis for plant by field spectroradiometer — sugar beets N87-11328

O

O RING SEALS
Structural behavior of the space shuttle SRM Tang-Clevis joint
[NASA-TM-89018] N87-11177
OBLIQUE WINGS
Flight-determined aerodynamic derivatives of the AD-1 oblique-wing research airplane
[NASA-TP-2222] N87-10871
OCEAN COLOR SCANNER
Advanced ocean color monitor (OCM) feasibility study, executive summary
[SNIAS-86-CA/LL/O] N87-11477
OCEAN CURRENTS
Determination of the circulation in the North Atlantic Ocean from climatological data N87-11425
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426
Modeling of mesoscale processes at oceanic fronts N87-11439
OCEAN DATA ACQUISITIONS SYSTEMS
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11284
OCEAN DYNAMICS
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244
AVHRR data processing for utilization in dynamical oceanography — Landsat radiometry N87-11302
Climate-effective transport processes in the ocean N87-11360
OCEAN MODELS
Interactive coupling of oceanic top layer models and atmospheric circulation models N87-11399
Coupled ocean-atmosphere models without drift of the prognostic variables N87-11402
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Modeling of mesoscale processes at oceanic fronts N87-11439
OCEAN SURFACE
An experimental campaign for the determination of radar structure of the ocean at C band N87-11239
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Analysis of airborne measurements of the marine boundary layer during the TOSCANE experiment — scatterometry N87-11250
The C and Ku band scatterometer results from Canadian participation in the ESA PROMESS ocean measurement campaign N87-11252
Downward long-wave irradiance at the ocean surface using satellite data N87-11303
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335
Analysis of mesoscale temperature and turbidity field — ocean surface layer N87-11457
OCEAN TEMPERATURE
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423
Long-term climate change in observed physical properties of the oceans
[DE86-009706] N87-11468
OCEANOGRAPHY
AVHRR data processing for utilization in dynamical oceanography — Landsat radiometry N87-11302
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11478
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645
OCEANS
Long-term climate change in observed physical properties of the oceans
[DE86-009706] N87-11468
OFFSHORE PLATFORMS
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
OILS
Heat exchangeable liquid injected compressors
[ETN-86-97852] N87-11166
ONBOARD DATA PROCESSING
High speed programmable processor for use on board satellites
[EPT/DI/006/GG/TT] N87-11497
A summary of DO-178A — airborne software certification
[PNR-90294] N87-11518
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE PREPRINT-33] N87-11648
ONBOARD EQUIPMENT
Electrostatic discharge effects on satellite electronic devices
[MATRA-CMT-138-JPG-078-85] N87-10953
ONE DIMENSIONAL FLOW
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174676] N87-10835
OPEN CHANNEL FLOW
Canalization of the atmospheric flow through valleys N87-11446
OPEN CIRCUIT VOLTAGE
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11068

OPERATORS (MATHEMATICS)
Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations
[PREPRINT-497] N87-11546
A convergence proof of a multigrid method
[REPT-85-39] N87-11556
OPTICAL COMMUNICATION
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 1: Executive summary
[NASA-CR-179479] N87-11058
OPTICAL CORRECTION PROCEDURE
An atmospheric correction method using Guzzi-spectroradiometer input data N87-11305
Estimation of atmospheric corrections from multiple aircraft imagery N87-11306
OPTICAL EMISSION SPECTROSCOPY
A new way of organizing spectral line intensity ratio fluctuations of different elements
[KGI-PREPRINT-068] N87-10989
A new method of organizing spectral line intensity ratio fluctuations of nightglow emissions
[KGI-PREPRINT-067] N87-11361
Concave diffraction gratings
[NPL-MOM-77] N87-11592
OPTICAL EQUIPMENT
Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597
OPTICAL FILTERS
Optical filtering techniques
[AD-A168084] N87-11596
OPTICAL GYROSCOPES
Development and test of a miniaturized fiber-optic gyroscope
[BMFT-FB-W-85-033] N87-11148
OPTICAL HETERODYNING
Sub-millimetre (far-IR) heterodyne spectrometer assembly — spaceborne platforms
[CD.6500689] N87-10958
Analysis of laser frequency stability of heterodyne measurements — interferometry
[NPL-MOM-78] N87-11153
OPTICAL MEASUREMENT
Improving radiation/contamination tests — satellite coating degradation
[CERT-419300/1-DERTS] N87-10954
Stability of multilayers for short-wavelength optics
[DE86-012129] N87-11598
OPTICAL PATHS
Wavelength selective demultiplexer tuner
[AD-D012264] N87-11106
OPTICAL RADAR
Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11284
The CO2 laser imaging spectroscopy for Earth observation N87-11285
Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983
[NASA-RP-1172] N87-11358
OPTICAL RANGE FINDERS
Passive stereoscopic rangefinder
[BAE-BT-12300] N87-11600
OPTIMAL CONTROL
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
On optimal passive and active control of precision spacecraft structures N87-10891
OPTIMIZATION
Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991
Local optimal determination of the wind field on sea from wind and pressure observations using an inverse method N87-11444
Reduction and reconstruction of control knowledge in rule based systems. Part 1: Reduction theory
[REPT-85-50] N87-11541
Multivariate calibration: A generalization of the classical estimator
[REPT-85-31] N87-11585
ORBIT PERTURBATION
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944
ORBIT TRANSFER VEHICLES
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10883
Status of advanced propulsion for space based orbital transfer vehicle
[NASA-TM-88848] N87-10959
Improved two-dimensional-kinetics computer program
[NASA-CR-179782] N87-11508
ORBITAL ELEMENTS
Search for orbital X-ray variation in Sco X-1
[MPE-PREPRINT-51] N87-11679
ORBITAL POSITION ESTIMATION
HEO multimission navigation concept N87-11052
ICE navigation support N87-11053
Demonstration of the fiducial concept using data from the March 1985 GPS field test N87-11055
ORBITAL SPACE STATIONS
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2
[ESA-CR(P)-2219] N87-10880
Development of deployable truss concept for space station N87-10923
HPSA: High Power Solar Array study — Columbus space station
[BAE-TP-8071] N87-11352
ORBITS
The structure of orbits in dynamical systems (revised version)
[REPT-85-28] N87-11554
ORCHARDS
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334
ORDER-DISORDER TRANSFORMATIONS
Some aspects of wave-functions in disordered and incommensurate models
[DE85-703226] N87-11610
Effective Landau theory for disordered interacting electron systems: Specific heat behavior
[PREPRINT-500] N87-11617
ORGANIZING
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
ORGANOMETALLIC COMPOUNDS
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987
OROGRAPHY
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11386
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400
Canalization of the atmospheric flow through valleys N87-11446
Orographic influence on regional flow conditions, the example of the Nouwieder basin. Numerical simulations N87-11458
OSCILLATING FLOW
Some calculations based on a mathematical model for fluid flow through a collapsible tube
[REPT-85-41] N87-11138
OSCILLATORS
Evolution of free-electron laser development
[DE86-006748] N87-11156
OUTCROPS
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
OXIDATION
High temperature oxidation of alloys. Oxidation mechanisms and experimental methods
[ETN-86-98071] N87-11002
Oxidation and low cycle fatigue life prediction N87-11215
OXIDATION RESISTANCE
Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit
[NASA-TM-88865] N87-10960
OXIDE FILMS
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169408] N87-11155
OXYGEN CONSUMPTION
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482
OXYGEN IONS
Discovery of energetic molecular ions (NO+ and O2+) in the storm time ring current — magnetic storms
[MPE-PREPRINT-53] N87-11356
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
OXYGEN PLASMA
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606
OXYGEN SPECTRA
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179863] N87-11672
OZONE
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018
Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353
Constructing a coherent long-term global total ozone climatology from the BUV, MFR, and SBUV/TOMS data sets
[DE86-009722] N87-11470

P

PACKAGING
Corrosion by polyurethane antistatic foams — microelectronic devices
[MQAD-R-343] N87-10984
PALEONTOLOGY
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375
Hydrological behavior pattern of isolated lakes and their role in paleoclimatology N87-11436
PANELS
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164
Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489
PARABOLIC ANTENNAS
New short-time alignment technique for 70-meter antenna surface panels N87-11026
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
PARABOLIC DIFFERENTIAL EQUATIONS
The solution of the parabolized Navier-Stokes equations
[CFD/86/2] N87-11130
Diagonally implicit Runge-Kutta methods for parabolic equations in conservation law form
[PREPRINT-980] N87-11552
PARABOLIC REFLECTORS
New short-time alignment technique for 70-meter antenna surface panels N87-11026
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
PARALLEL COMPUTERS
Multiprocessing the Sieve of Eratosthenes
[NASA-CR-178131] N87-11509
Data communication in parallel architectures
[AD-A169302] N87-11531
PARALLEL PROCESSING (COMPUTERS)
WEST-3 wind turbine simulator development. Volume 1: Summary
[NASA-CR-174981] N87-11348
Parallel processors and nonlinear structural dynamics algorithms and software
[NASA-CR-179889] N87-11511
Gaussian elimination on hypercubes
[AD-A169293] N87-11514
Data communication in parallel architectures
[AD-A169302] N87-11531
Machine learning using a higher order correlation network
[DE86-010183] N87-11537
A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540
PARAMETER IDENTIFICATION
Correlation between flight simulation and processing of flight tests based on inertial measurements
[NLR-MP-85058-U] N87-10863
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle
[NASA-TM-85758] N87-10869
Follow-on proposal identifying environmental features for land management decisions
[NASA-CR-179703] N87-11236
Determination of land surface parameters by satellite and associated inverse problems N87-11253
PARAMETERIZATION
Effective modal parameters and truncation effects in structural dynamics N87-10897
On a simple vibration control design for large space structure models with uncertain parameters N87-10903

Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11265
Dry deposition parameterization in long range transport models — pollution transport
[KNMI-WR-86-1] N87-11354
Subgrid parameterization in flows with helicity N87-11382
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11386
Measurement, calculation, and parameterization of atmospheric heat radiation N87-11390
A comparison between detailed and parameterized formulations of droplet/droplet coagulation mechanisms N87-11392
A simple parameterization scheme for the determination of the relative coverage by cumulus clouds N87-11393
Cloud parameterization with a statistical method N87-11401
Simulation of the cloud coverage in a climate model N87-11404
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441

PARSING ALGORITHMS
Abstract grammars based on transductions
[INF-85-13] N87-11522

PARTIAL DIFFERENTIAL EQUATIONS
Comparison of some partial differential equation models of flexible structures
[TW-270] N87-11559
Linear stability of the hopscotch scheme
[CWI-NM-R8603] N87-11560
Convergence analysis of one-step schemes in the method of lines
[CWI-NM-R8608] N87-11563

PARTICLE ACCELERATION
Physics and event simulation at HERA with H1 (report of the Working Group of the H1 Collaboration for HERA)
[NOTA-INTERNA-854] N87-11582

PARTICLE BEAMS
Research issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985
[AD-A169268] N87-11062

PARTICLE COLLISIONS
Light gluinos at the CERN ppbar collector — supersymmetry theory
[PREPRINT-470] N87-11585
Scaling violation in hadronic interactions and the deep underground flux of cosmic muons — particle collision experiment
[PREPRINT-495] N87-11682

PARTICLE DIFFUSION
A space radiation test model study
[AD-A169412] N87-11681

PARTICLE MASS
Light gluinos at the CERN ppbar collector — supersymmetry theory
[PREPRINT-470] N87-11585

PARTICLE MOTION
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program
[BO-RP-AI-004] N87-11016
A space radiation test model study
[AD-A169412] N87-11681

PARTICLE PRODUCTION
Light gluinos at the CERN ppbar collector — supersymmetry theory
[PREPRINT-470] N87-11585

PARTICLE THEORY
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621

PARTICLES
Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts
[DE86-011778] N87-11000
A fast algorithm for particle simulations
[AD-A169294] N87-11515

PASSENGER AIRCRAFT
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90298] N87-10867

PATENT POLICY
Catalytic production of carboxylic acids or anhydrides from olefins
[GB-PATENT-2-140-004-A] N87-10983

PATHOLOGY
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479

PATTERN RECOGNITION
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A168042] N87-11595

PAVEMENTS
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia
[AD-A169284] N87-10677

PAYLOAD INTEGRATION
Space shuttle payload design and development N87-10666

PAYLOAD INTEGRATION PLAN
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10693

PAYLOADS
Launcher-payload dynamic interaction N87-10900

PENETRATION
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160

PERFORMANCE PREDICTION
Choice of resin when using different carbon fiber types N87-10969
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Investigation of long term storage effects on aerospace nickel-cadmium cell performance N87-11090
Surface protection N87-11182
High temperature stress-strain analysis N87-11209

PERFORMANCE TESTS
Qualification testing of general electric 50 Ah nickel-cadmium cells with new separator and new positive plate processing N87-11084
Satellite battery testing status N87-11091
Voltage-temperature charge verification testing of 34 ampere-hour nickel-cadmium cells N87-11092
NOAA 26.5 Ah LEO characterization test N87-11093
Parametric tests of a 40-Ah bipolar nickel-hydrogen battery N87-11100
Analysis of loop current step response data obtained from in situ tests of temperature detectors
[DE86-011750] N87-11147
Evaluation results of the 700 deg C Chinese strain gages N87-11189
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190
Develop and test fuel cell powered on site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175118] N87-11344

PERIODIC VARIATIONS
Computational methods in elastic periodic structures analyses N87-10901
Search for orbital X-ray variation in Sco X-1
[MPE-PREPRINT-51] N87-11679
Disappearance of periodic X-ray minima in AM Her
[MPE-PREPRINT-52] N87-11680

PERMEABILITY
Effective conductivity of aging polyurethane foam
[DE86-008939] N87-11011

PERMITTIVITY
Snow studies: Study journey to Switzerland, January 1986
[FOA-C-30419-E1,E3] N87-11341

PERSONAL COMPUTERS
Guide to sharing personal computer resources via local area networks
[DE86-009665] N87-11532

PERSONNEL
Manufacturing planning in machine building from the point of view of management and workshop personnel N87-11503

PHASE DIAGRAMS
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179681] N87-11671

PHASE ERROR
A method to dramatically improve subcarrier tracking N87-11035
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046

PHASE LOCKED SYSTEMS
An estimator-predictor approach to PLL loop filter design N87-11033
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035
A method to dramatically improve subcarrier tracking N87-11036
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046

PHASE SHIFT
NBS (National Bureau of Standards) 50 kHz phase angle calibration standard
[PB86-201274] N87-11151

PHASE TRANSFORMATIONS
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179636] N87-11619

PHENOMENOLOGY
Phenomenology of the evolution of large-scale boundary layer structures N87-11416

PHOSPHORIC ACID
Develop and test fuel cell powered on site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175118] N87-11344

PHOSPHORIC ACID FUEL CELLS
Develop and test fuel cell powered on-site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175117] N87-11346

PHOTOCHEMICAL OXIDANTS
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451

PHOTODECOMPOSITION
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design
[CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating
[CERT-4193-VOL-2] N87-10950
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings
[CERT-4193-VOL-3] N87-10951
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings
[CERT-4193-VOL-4] N87-10952

PHOTOELECTRIC EMISSION
Electron transport in integral photoemission X-ray standing wave analysis
[USIP-86-03] N87-11614

PHOTOELECTRICITY
Radiation upset threshold detector apparatus
[AD-D012260] N87-11145

PHOTOGRAMMETRY
Description of crop geometry, restricted to parts viewed N87-11273

PHOTOGRAPHIC FILM
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179833] N87-11142
Method and apparatus for high speed, sustained recording of infrared laser beam patterns
[AD-D012265] N87-11154

PHOTOMETRY
Photometric redshifts and cosmology N87-11658

PHOTON DENSITY
A new way of organizing spectral line intensity ratio fluctuations of different elements
[KGI-PREPRINT-068] N87-10989

PHOTONS
Hyperphotons and K meson decays
[PREPRINT-498] N87-11588

PHOTOSPHERE
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677

PHYSICAL EXERCISE
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482

PHYSICAL OPTICS
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Langevin equations With negative diffusion coefficients. A new approach to quantum optics
[NOTA-INTERNA-862] N87-11599

PHYSIOLOGICAL EFFECTS
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482

PHYSIOLOGICAL RESPONSES
Controlling the temporal structure of limb movements: A response
[AD-A169261] N87-11488

PILOT PERFORMANCE
Low-cost avionics simulation for aircrew training
[AD-A169198] N87-10865

Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485

PILOTS (PERSONNEL)
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study
[NASA-TP-2616] N87-10864
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487

PINCH EFFECT
Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607

PIPE FLOW
The dynamics of heat transfer in turbulent pipe flow, part 3
[OEFZS-4351] N87-11133
Some calculations based on a mathematical model for fluid flow through a collapsible tube
[REPT-85-41] N87-11138

PIPER AIRCRAFT
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242

PITTING
Comparison of the effects of alloyed molybdenum and aqueous molybdate on the pitting resistance of iron-chromium alloys
[DE86-011918] N87-10997

PLANAR STRUCTURES
Printed circuit transmission line transitions
[AD-A169291] N87-11110

PLANETARY BOUNDARY LAYER
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461

PLANETARY COMPOSITION
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179881] N87-11671

PLANETARY CORES
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670

PLANETARY MAGNETIC FIELDS
Types and properties of planetary tori and limit on mass loss from satellites N87-11666

PLANKTON
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335

PLANT STRESS
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309

PLASMA CLOUDS
Active plasma experiments — Active Magnetic Particle Tracer Explorers (AMPTE) project
[MPE-PREPRINT-43] N87-11603
Diamagnetic effect and anomalous transport in expanding plasma clouds — Active Magnetic Particle Tracer Explorer (AMPTE) satellite experiment simulations
[MPE-PREPRINT-26] N87-11647

PLASMA CONTROL
Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607

PLASMA COOLING
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606

PLASMA CURRENTS
The current system generated by the PORCUPINE artificial ion beam in the ionospheric background plasma
[MPE-PREPRINT-49] N87-11355

PLASMA DENSITY
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606

PLASMA DIAGNOSTICS
Active plasma experiments — Active Magnetic Particle Tracer Explorers (AMPTE) project
[MPE-PREPRINT-43] N87-11603
Activities report of the Institute for Plasma Research
[ETN-86-98253] N87-11608

PLASMA DIFFUSION
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605

PLASMA DYNAMICS
A fast algorithm for particle simulations
[AD-A169294] N87-11515

PLASMA EQUILIBRIUM
A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma
[AD-A168082] N87-11606

PLASMA INTERACTION EXPERIMENT
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946

PLASMA INTERACTIONS
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605

PLASMA JETS
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605

PLASMA PHYSICS
Activities report of the Institute for Plasma Research
[ETN-86-98253] N87-11608
Study of a discharge produced by a standing surface wave — plasma physics
[LP-213] N87-11609

PLASMA PINCH
Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607

PLASMA SPRAYING
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196

PLASMA-ELECTROMAGNETIC INTERACTION
Active plasma experiments — Active Magnetic Particle Tracer Explorers (AMPTE) project
[MPE-PREPRINT-43] N87-11603

PLASMAGUIDES
Analysis of directional coupler signals in an overmoded waveguide system — plasma heating systems
[IPF-85-2] N87-11067
Components for transmission of very high power mm waves (200 kW at 28, 70 and 140 GHz) in overmoded circular waveguides — plasmaguides
[IPF-86-2] N87-11068

PLATES (TECTONICS)
Active Tectonics: Part 2: Epeirogenic and intraplate movements N87-11357

PLUMES
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992

POLAR CAPS
Study of the performances of SEASAT satellite over ice and sea ice
[CNES-CS/MM/82/117/CT/GRGS] N87-10955

POLARIZATION CHARACTERISTICS
The effect of electromagnetic wave polarization on wave attenuation in a vegetation canopy N87-11257

POLARIZED ELECTROMAGNETIC RADIATION
The effect of electromagnetic wave polarization on wave attenuation in a vegetation canopy N87-11257

POLLUTION TRANSPORT
Dry deposition parameterization in long range transport models — pollution transport
[KNMI-WR-86-1] N87-11354
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370
A statistical method for prediction of pollutant emission N87-11428
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430
Dispersion of accidentally released heavy gases — wind tunnel tests N87-11432

POLYIMIDES
A new readily processable polyimide
[NASA-TM-89253] N87-11008

POLYMERIC FILMS
Effects of backing plates on the electron exposure of thin polymer films
[NASA-TM-88995] N87-11589

POLYMERIZATION
Fractal aspects of ceramic synthesis
[DE86-011657] N87-11012

POLYNOMIALS
On Karmarkar's projective method for linear programming
[REPT-85-23] N87-11527

POLYQUINOXALINES
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010

POLYURETHANE FOAM
Corrosion by polyurethane antistatic foams — microelectronic devices
[MQAD-R-343] N87-10984
Effective conductivity of aging polyurethane foam
[DE86-008939] N87-11011

POLYURETHANE RESINS
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study
[AD-A169398] N87-10978

POLYVINYL FLUORIDE
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179836] N87-11619

POSITION (LOCATION)
Multifractal wave function at the localization threshold
[PREPRINT-499] N87-11547

POSITRON ANNIHILATION
The discovery of the positron
[PREPRINT-469] N87-11584

POSITRONS
The discovery of the positron
[PREPRINT-469] N87-11584

POWDER (PARTICLES)
A survey of recent developments in X-ray diffractometry
[MQAD-TR-910] N87-10963
Processing of laser formed SiC powder
[NASA-CR-179857] N87-11009

POWER AMPLIFIERS
The 20 GHz GaAs monolithic power amplifier module development
[NASA-CR-179830] N87-11104

POWER CONDITIONING
Research Issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985
[AD-A169268] N87-11062
A high reliability battery management system N87-11094

POWER CONVERTERS
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard — spaceborne radar
[ESA-CR(P)-2249] N87-11116

POWER SPECTRA
Signal processing and interpretation using multilevel signal abstractions
[AD-A169166] N87-11513

PREAMPLIFIERS
X-band preamplifier filter N87-11048

PRECIPITATION (METEOROLOGY)
Test of a simple cloud model with precipitation N87-11452
Report of the Workshop on Global Large-Scale Precipitation Data Sets for the World Climate Research Programme
[WCP-111] N87-11472
The IMIS program NESO
[REPT-84-1] N87-11521

PRECISION
Development of precision turning capabilities at Lawrence Livermore National Laboratory
[DE86-011884] N87-11162

PREDICTION ANALYSIS TECHNIQUES
Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11060
The prediction of tool pressures in coining
[WPB-0132] N87-11173
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180
Host turbine heat transfer overview N87-11184
Turbine airfoil deposition models N87-11191
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192
Effects of surface chemistry on hot corrosion life N87-11193
Coating life prediction N87-11194
Introduction to life modeling of thermal barrier coatings N87-11195
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196

Thermal barrier coating life prediction model development N87-11197
Thermal barrier coating life prediction model development N87-11198
Thermal barrier coating life prediction model development N87-11199
Aerothermal modeling program, phase 2 N87-11200
Lateral jet injection into typical combustor flowfields N87-11203
Component specific modeling N87-11207
High temperature stress-strain analysis N87-11209
High-temperature constitutive modeling N87-11210
Creep fatigue life prediction for engine hot section materials (isotropic): Two year update N87-11213
Elevated temperature crack growth N87-11214
Oxidation and low cycle fatigue life prediction N87-11215
Life prediction and constitutive models for engine hot section anisotropic materials N87-11218
Turbine airfoil gas side heat transfer N87-11219
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Gas flow environmental and heat transfer nonrotating 3D program N87-11223
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224
Coolant passage heat transfer with rotation, a progress report N87-11225
A statistical method for prediction of pollutant emission N87-11428
On local and nonlocal measures of efficiency — testing and estimation theory [ISSN-0169-2690] N87-11566

PREDICTIONS
Calculating and predicting the properties of materials [DE86-011557] N87-10964
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
The internal memory of open hydrodynamic systems N87-11414

PREFORMS
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples [ETN-86-97826] N87-11170

PRESSURE DISTRIBUTION
Practical evaluation of wall pressure signature correction methods in the 2.7m x 2.1m low speed wind tunnel [BAE-ARG-204] N87-10874

PRESSURE EFFECTS
Some calculations based on a mathematical model for fluid flow through a collapsible tube [REPT-85-41] N87-11138

PRESSURE MEASUREMENT
NASA dilution jet mixing, phase 3 N87-11202

PRESSURE VESSELS
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939
Design of low alloy steels for thick walled pressure vessels [DE86-011748] N87-10996

PRINTED CIRCUITS
Printed circuit transmission line transitions [AD-A169291] N87-11110
Microstrip amplitude-weighted wilkinson power dividers [AD-A169450] N87-11111

PROBABILITY DISTRIBUTION FUNCTIONS
Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom [NOTA-INTERNA-859] N87-11564

PROBABILITY THEORY
On local and nonlocal measures of efficiency — testing and estimation theory [ISSN-0169-2690] N87-11566
Probabilistic solutions of generalized birth and death equations and application to nonrelativistic electrodynamics [PREPRINT-483] N87-11625

PROBLEM SOLVING
The solution of the parabolized Navier-Stokes equations [CFD/86/2] N87-11130
On Karmarkar's projective method for linear programming [REPT-85-23] N87-11527
An efficient method for solving the steady Euler equations [NASA-TM-87329] N87-11543
CONST: A constructive approach to information modeling [REPT-85-44] N87-11637

PRODUCT DEVELOPMENT
Reliability and economics of spacecraft structure development N87-10921
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
Development of single crystal alloys for specific engine applications [PNR-90320] N87-11616
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight [BMFT-FB-W-85-025] N87-11655

PRODUCTION MANAGEMENT
Engineers: Can they be managed? [PNR-90307] N87-11627

PRODUCTION PLANNING
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies [KFK-PFT-119] N87-11500
Manufacturing planning in machine building from the point of view of management and workshop personnel N87-11503

PROGNOSIS
A two-dimensional numerical model for fog prognosis N87-11387

PROGRAM VERIFICATION (COMPUTERS)
Verification of two communication protocols by means of process algebra [CWI-CS-R8608] N87-11064
Analysis of loop current step response data obtained from in situ tests of temperature detectors [DE86-011750] N87-11147

PROGRAMMING LANGUAGES
Orwellian programming in safety-critical systems [RSRE-MEMO-3924] N87-11499
A survey of functional programming language principles [NASA-TM-89019] N87-11506

PROJECT MANAGEMENT
Implementation of windmills in Gujarat, India [ETN-86-97720] N87-11342
Engineers: Can they be managed? [PNR-90307] N87-11627
National Aeronautics and Space Administration Authorization Act, 1987 [H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986 [H-REPT-99-829] N87-11641

PROJECT SETI
Objectives and first results of the NASA SETI sky survey field tests at Goldstone N87-11054

PROP-FAN TECHNOLOGY
PTA test bed aircraft engine inlet model test report, revised [NASA-CR-174845] N87-10866
Prop-fan slipstream effects using static simulators: Low speed task, phase 1 [BAE-B59R/R-D/610/13498] N87-10875

PROPELLER BLADES
Effect of angular inflow on the vibratory response of a counter-rotating propeller [NASA-CR-174819] N87-10840
An experimental investigation of the interior noise control effects of propeller synchrophasing [NASA-CR-178185] N87-11577

PROPELLER DRIVE
Propeller aircraft interior noise model utilization study and validation [NASA-CR-172428] N87-11576
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579

PROPELLER SLIPSTREAMS
Prop-fan slipstream effects using static simulators: Low speed task, phase 1 [BAE-B59R/R-D/610/13498] N87-10875

PROPORTIONAL COUNTERS
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's) [MPE-PREPRINT-33] N87-11648
The position sensitive proportional counter (PSPC) of the ROSAT telescope [MPE-PREPRINT-32] N87-11649

PROPULSION SYSTEM PERFORMANCE
Aeronautical facilities assessment [NASA-RP-1146] N87-10876
Status of advanced propulsion for space based orbital transfer vehicle [NASA-TM-88848] N87-10959

PROTECTIVE COATINGS
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design [CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating [CERT-4193-VOL-2] N87-10950
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings [CERT-4193-VOL-3] N87-10951
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings [CERT-4193-VOL-4] N87-10952
Improving radiation/contamination tests — satellite coating degradation [CERT-419300/1-DERTS] N87-10954
Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit [NASA-TM-88865] N87-10960
Surface protection N87-11182
Turbine airfoil deposition models N87-11191
Coating life prediction N87-11194

PROTOCOL (COMPUTERS)
Verification of two communication protocols by means of process algebra [CWI-CS-R8608] N87-11064
Software tools for the design of protocol systems, part 1 [INF-85-21] N87-11523

PROTOTYPES
Hot section viewing system [NASA-CR-174773] N87-11144
A prototype space flight intravenous injection system [NASA-CR-171911] N87-11481
Experiences with a data analysis management prototype [DE86-011615] N87-11626

PROVING
The design analysis and verification of a satellite N87-10916

PULSE COMMUNICATION
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas [NASA-CR-4024] N87-10854

PULSED LASERS
Single-pulse laser effects measurements at 248 nm [DE86-011229] N87-11157
Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11284

PULSES
Miniature high performance pulsed modulator apparatus [AD-D012266] N87-11107

PURITY
Processing of laser formed SiC powder [NASA-CR-179857] N87-11009

PUSHBROOM SENSOR MODES
Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer [NASA-TM-89005] N87-11105
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277

PYLONS
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1 [NASA-CR-172355] N87-10860

PYRENEES MOUNTAINS (EUROPE)
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270

Q

QUALITY CONTROL
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986 [PB86-206364] N87-11021

QUANTUM CHROMODYNAMICS
The Array Processor with Emulator (APE) project: A computer for lattice QCD [NOTA-INTERNA-839] N87-11495
An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse [NOTA-INTERNA-855] N87-11623

QUANTUM COUNTERS
The external muon detector for ICARUS
[NOTA-INTERNA-863] N87-11583
QUANTUM ELECTRODYNAMICS
Probabilistic solutions of generalized birth and death equations and application to nonrelativistic electrodynamics
[PREPRINT-483] N87-11625
QUANTUM MECHANICS
Vacuum polarization on black hole spacetimes N87-11668
Quantum effects in non-maximally symmetric spaces N87-11669
QUANTUM THEORY
Langevin equations With negative diffusion coefficients. A new approach to quantum optics
[NOTA-INTERNA-862] N87-11599
An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse
[NOTA-INTERNA-855] N87-11623
An alternative model for the density of states in the Quantum Hall Effect
[NOTA-INTERNA-858] N87-11624
QUASARS
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651
QUENCHING (COOLING)
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10968
QUERY LANGUAGES
Translation and optimization of logic queries: The algebraic approach — data bases
[REPT-86-004] N87-11631
QUEUEING THEORY
A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540

R

RADAR ATTENUATION
The effect of electromagnetic wave polarization on wave attenuation in a vegetation canopy N87-11257
RADAR CROSS SECTIONS
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
Analysis of the ESA wind scatterometer campaign data N87-11251
RADAR DETECTION
Spectral analysis for radar using linear predictive filtering
[RSRE-MEMO-3896] N87-11022
RADAR ECHOES
Spectral analysis for radar using linear predictive filtering
[RSRE-MEMO-3896] N87-11022
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Evolution of sodar echoes as a climatological characteristic of the boundary layer N87-11459
RADAR IMAGERY
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Simulation of multitemporal SAR images N87-11256
RADAR MEASUREMENT
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445
RADAR RESOLUTION
Spectral analysis for radar using linear predictive filtering
[RSRE-MEMO-3896] N87-11022
RADAR SCATTERING
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
Backscatter measurements from simulated vegetation structures N87-11254
Experiments on modeling radar backscatter of forest stands and research on classification N87-11259
Wind tunnel investigation of the characterization of radar backscattering by different wave fields — sea waves N87-11261
Scattering models for coniferous and deciduous vegetation N87-11263
RADAR SIGNATURES
An experimental campaign for the determination of radar structure of the ocean at C band N87-11239
Spaceborne SAR depolarisation ambiguities N87-11260
RADAR TARGETS
In-flight calibration during PROMESS campaign — radar targets N87-11245
RADIANCE
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
RADIATION BELTS
A space radiation test model study
[AD-A169412] N87-11681
RADIATION COUNTERS
Physics and event simulation at HERA with H1 (report of the Working Group of the H1 Collaboration for HERA)
[NOTA-INTERNA-854] N87-11582
RADIATION DAMAGE
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design
[CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating
[CERT-4193-VOL-2] N87-10950
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings
[CERT-4193-VOL-3] N87-10951
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings
[CERT-4193-VOL-4] N87-10952
Radiation upset threshold detector apparatus
[AD-D012260] N87-11145
RADIATION DETECTORS
Radiation upset threshold detector apparatus
[AD-D012260] N87-11145
RADIATION DOSAGE
The effects of space radiation on a chemically modified graphite-epoxy composite material
[NASA-TM-89232] N87-10977
Effects of backing plates on the electron exposure of thin polymer films
[NASA-TM-88995] N87-11589
RADIATION EFFECTS
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479
RADIATION HARDENING
Radiation hardness assurance of electronic components, with special reference to semiconductor devices and evaluation statistics
[BAE-BT-13601] N87-11113
RADIATION TRANSPORT
Solar radiation transport in realistic atmospheres with 3-dimensional cloud fields N87-11412
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
RADIATIVE HEAT TRANSFER
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080
Combustion overview N87-11181
RADIATIVE TRANSFER
A scene radiation model based on four-stream radiative transfer theory — multispectral remote sensing N87-11262
Downward long-wave irradiance at the ocean surface using satellite data N87-11303
RADIO ALTIMETERS
Study of the performances of SEASAT satellite over ice and sea ice
[CNES-CS/MM/82/117/CT/GRGS] N87-10955
RADIO ANTENNAS
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
A prototype DSN X/S-band feed: Model 3 development N87-11027
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028
VLA feedhorn for Voyager encounter of Neptune N87-11047
X-band preamplifier filter N87-11048
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Deep space network Mark 4A description N87-11051
Objectives and first results of the NASA SETI sky survey field tests at Goldstone N87-11054
RADIO ASTRONOMY
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665
RADIO COMMUNICATION
Tropospheric scatter communication system having angle diversity
[AD-D012263] N87-11058
RADIO CONTROL
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
RADIO FREQUENCIES
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061
Radiofrequency amplifier based on a dc superconducting quantum interference device
[AD-D012353] N87-11109
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150
RADIO NAVIGATION
GRANAS: Global Radio Navigation System
[BMFT-FB-W-85-034] N87-10857
RADIO TRANSMISSION
Propagation of signals in the frequency band between 30 MHz and 100 MHz
[AD-A169332] N87-11083
RADIOACTIVE DECAY
Hyperphotons and K meson decays
[PREPRINT-498] N87-11588
RADIOACTIVE MATERIALS
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-008703] N87-11480
RADIOMETERS
Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer
[NASA-TM-89005] N87-11105
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304
Constructing a coherent long-term global total ozone climatology from the BUV, MFR, and SBUV/TOMS data sets
[DE86-009722] N87-11470
RAIN GAGES
Spatial analysis of storm depths from an Arizona raingage network
[NASA-CR-177186] N87-11463
RAINDROPS
A comparison between detailed and parameterized formulations of droplet/droplet coagulation mechanisms N87-11392
Thermodynamic aspects of the absorption of gas in droplets N87-11421
RAINSTORMS
Spatial analysis of storm depths from an Arizona raingage network
[NASA-CR-177186] N87-11463
RANDOM ACCESS MEMORY
An assessment of CD ROM (Compact Disk Read Only Memory)
[AD-A169259] N87-11492
RANDOM NOISE
Low frequency response of axisymmetric structures to random noise — Ariane N87-10908
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Guassian noise channel N87-11034
RARE GASES
A summary of gas shielded arc welding
[BAE-BT-14107] N87-11167
RAREFIED GAS DYNAMICS
On Knudsen flows within thin tubes
[PREPRINT-97] N87-11137
RATIOS
Pairwise-comparison methods using fuzzy numbers on ratio scales with geometric progression — decision theory
[REPT-85-24] N87-11553
RATS
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479
REACTION KINETICS
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10968
The crystallization of tough thermoplastic resins in the presence of carbon fibers
[NASA-CR-179810] N87-11006
REACTOR SAFETY
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591

READ-ONLY MEMORY DEVICES
An assessment of CD ROM (Compact Disk Read Only Memory)
[AD-A169259] N87-11492
REAL TIME OPERATION
TUMULT: A distributed real-time multi-processor system
[INF-85-3] N87-11496
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507
EOS: A project to investigate the design and construction of real-time distributed embedded operating systems
[NASA-CR-179674] N87-11510
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516
Real time debugging software package for flight simulator software system with variable labeled COMMON blocks
[NLR-MP-85013-U] N87-11530
A survey of the Twente University MULTIprocessor (TUMULT) system, a real time multiprocessor system
[INF-85-22] N87-11533
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A168042] N87-11595
RECEPTION DIVERSITY
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Guassian noise channel N87-11034
Tropospheric scatter communication system having angle diversity
[AD-D012263] N87-11058
RECHARGING
Sodium-sulfur batteries for spacecraft energy storage N87-11074
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
A 65 Ah rechargeable lithium molybdenum disulfide battery N87-11082
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
RECIPROCITY THEOREM
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179833] N87-11142
RECONNAISSANCE
Tropical cyclone report, 1985
[AD-A168284] N87-11464
RECORDING
Method and apparatus for high speed, sustained recording of infrared laser beam patterns
[AD-D012265] N87-11154
RECTANGULAR WAVEGUIDES
Development of equipment for the 20/30 GHz payload of a satellite for propagation and transmission experiments
[BMFT-FB-W-85-035] N87-10948
RECURSIVE FUNCTIONS
A recursive solution for a fading memory filter derived from Kalman filter theory N87-11032
Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations
[PREPRINT-497] N87-11546
A convergence proof of a multigrid method
[REPT-85-39] N87-11556
RECYCLING
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia
[AD-A169284] N87-10877
RED SHIFT
Photometric redshifts and cosmology N87-11658
REDUCED GRAVITY
Study on a drop and bubble unit. Volume 1: Executive study — spaceborne experiments
[ESA-CR(P)-2256] N87-10661
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program
[BO-RP-AI-004] N87-11016
REFLECTANCE
Improving radiation/contamination tests — satellite coating degradation
[CERT-419300/1-DERTS] N87-10954
Canopy reflectance modeling in a tropical wooded grassland
[NASA-CR-178895] N87-11237
Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11265
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267
Geometric model simulations of conifer canopy reflectance N87-11269
Reflectivity contrast of forested slopes with snow-covered ground N87-11271
Airborne measurements of the spectral reflectance of freshwater ice N87-11280
Radiometric data characterize quantization of soil forming minerals N87-11281
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304
Spectral study of rocks and some iron deposits from Eastern China N87-11308
REFLECTOR ANTENNAS
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060
REFLECTORS
Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit
[NASA-TM-88865] N87-10960
REFRACTION
Wavelength selective demultiplexer tuner
[AD-D012264] N87-11106
REFRACTORY MATERIALS
On the numerical integration of viscoplastic models — high temperature materials
[KFK-4082] N87-11135
REFRIGERATORS
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164
REGENERATIVE FUEL CELLS
NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073
Energy storage systems comparison for the space station N87-11075
REGRESSION ANALYSIS
Multivariate calibration: A generalization of the classical estimator
[REPT-85-31] N87-11565
REGULATIONS
Regulations, criteria, and measurement practice for susceptibility criteria — electromagnetic susceptibility
[NLR-MP-84089-U] N87-11065
RELATIVISTIC PARTICLES
On the radiation emitted by a particle falling into a black hole in the semirelativistic approximation
[NOTA-INTERNA-857] N87-11664
RELATIVISTIC THEORY
On the radiation emitted by a particle falling into a black hole in the semirelativistic approximation
[NOTA-INTERNA-857] N87-11664
RELIABILITY ENGINEERING
Design and verification activities and requirements for spacecraft structures N87-10690
Reliability and economics of spacecraft structure development N87-10921
Investigation of optimal complexity of BITE and its effects on reliability, maintainability, monitoring and fault prediction — Built-In Test (BITE) electronic systems
[ETN-86-97976] N87-11175
A proposal for a new software reliability model and its preliminary assessment
[REPT-86-001] N87-11519
REMOTE SENSING
Remote sensing methods to determine the vitality of vegetation
[LITERATUUROVERZICHT-42] N87-11235
Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing — conference
[ESA-SP-247] N87-11238
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244
Determination of land surface parameters by satellite and associated inverse problems N87-11253
A scene radiation model based on four-stream radiative transfer theory — multispectral remote sensing N87-11262
Modelisation of the optical scattering behaviour of the vegetation canopies N87-11264
Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11265
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267
The physical and physiological interpretation of vegetation spectral signatures N87-11272
Description of crop geometry, restricted to parts viewed N87-11273
Imaging spectrometry: Past, present, future N87-11274
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278
Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11284
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293
Analysis of multilevel measurements of spectral signatures for less-favored areas — agriculture, land use N87-11301
Microwave sensing of atmospheric water using the future AMSU system N87-11307
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
Characterising vegetated surfaces with airborne MSS data — Multispectral Scanner (MSS) N87-11315
Spectral signature of snow in visible and near-infrared wavelengths N87-11316
Ground level radiometric monitoring of rainy season food crops in the Sahel N87-11317
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324
Reflectance properties of barley for different agronomical treatments N87-11326
Contribution of internal waves to spectral signatures N87-11331
Travel report of a visit to the United States from 17 August to 31 August 1985
[ICW-1659] N87-11339
Remote sensing in hydrology — aerial photography
[ICW-1687] N87-11340
Report of the COSPAR International Workshop on Satellite-Derived Sea Surface Temperatures for Global Climate Applications
[WCP-110] N87-11471
Report of the Workshop on Global Large-Scale Precipitation Data Sets for the World Climate Research Programme
[WCP-111] N87-11472
NASA Space Program
[S-HRG-99-691] N87-11642
Aeronautics and space report of the President N87-11683
REMOTE SENSORS
High-spectral resolution remote sensing instruments developed and under development at CNES N87-11276
Absolute calibration of remote sensing instruments N87-11292
Snow studies: Study journey to Switzerland, January 1986
[FOA-C-30419-E1,E3] N87-11341
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343
Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485
REQUIREMENTS
Aerospace nickel-cadmium cell separator qualifications program N87-11065
RESEARCH AIRCRAFT
Flight-determined aerodynamic derivatives of the AD-1 oblique-wing research airplane
[NASA-TP-2222] N87-10871
RESEARCH AND DEVELOPMENT
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
National Aeronautics and Space Administration Authorization Bill, 1986
[H-REPT-99-829] N87-11641
The 1987 NASA authorization, volume 1
[GPO-60-960] N87-11643
RESEARCH FACILITIES
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591
RESEARCH MANAGEMENT
Research in the area of visual search
[AD-A168923] N87-11483

RESIDENTIAL ENERGY
Residential Earth-coupled heat pump demonstration [PB86-212396] N87-11141
RESIDUAL STRESS
Measurement of stress distributions in adhesive bonded joints [AD-A169176] N87-11227
Stress and efficiency studies in EFG [NASA-CR-179814] N87-11618
RESIN MATRIX COMPOSITES
Material selection for carbon fiber reinforced composite structures — conferences [ESA-TT-950] N87-10965
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967
Choice of resin when using different carbon fiber types N87-10969
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
RESINS
The interface between fiber and matrix resin from a chemical point of view N87-10970
RESONANCE
Resonance capture and Saturn's rings [DE86-011733] N87-11674
RESONANT FREQUENCIES
Passive damping concepts for slender columns in space structures [NASA-CR-179807] N87-11178
RESOURCES MANAGEMENT
Follow-on proposal identifying environmental features for land management decisions [NASA-CR-179703] N87-11236
RESPONSE TIME (COMPUTERS)
Minimizing the response time of a query in a distributed data base [INF-85-26] N87-11634
REVERBERATION
Acoustic radiation and internal dissipation in honeycomb panels N87-10909
REYNOLDS NUMBER
Report on tests of a CAST 10 airfoil with fixed transition in the T2 transonic cryogenic wind tunnel with self-adaptive walls [RT-OA-63/1685] N87-10834
RHEOLOGY
Electro-rheological fluids. A brief description and typical applications [BAE-BT-13744] N87-11132
RING CURRENTS
Discovery of energetic molecular ions (NO+ and O2+) in the storm time ring current — magnetic storms [MPE-PREPRINT-53] N87-11356
RITZ AVERAGING METHOD
Extension of the Ritz method to the forced, damped vibrations of rotating structural elements N87-11234
ROADS
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia [AD-A169284] N87-10877
ROBOTICS
Control of a free-flying robot manipulator system [NASA-CR-179877] N87-11159
On robots with flexible links: Dynamics, control and stability [REPT-85-34] N87-11171
Characterization and control of object acquisition using a robot hand N87-11174
CESAR research in intelligent machines [DE86-006226] N87-11494
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A [NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B [NASA-CR-172403] N87-11535
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide [NASA-CR-178051] N87-11536
Advances in concurrent computers for autonomous robots [DE86-006236] N87-11538
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics [AD-A169175] N87-11572
ROBOTS
Image based visual servo control of a revolute-coordinate (arm and elbow) robot [RR-288] N87-11169
Computer aided design of robot manipulators and their operations [NLR-MP-85012-U] N87-11172
Characterization and control of object acquisition using a robot hand N87-11174
CESAR research in intelligent machines [DE86-006226] N87-11494
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies [KFK-PFT-119] N87-11500
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
Advances in concurrent computers for autonomous robots [DE86-006236] N87-11538
ROBUSTNESS (MATHEMATICS)
A methodology for designing robust multivariable nonlinear control systems [NASA-CR-179891] N87-11567
ROCKET EXHAUST
Experimental verification of rocket exhaust plumes and impingement effects on spacecraft surfaces [DFVLR-IB-22-85-A-29] N87-10961
ROCKET SOUNDING
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight [BMFT-FB-W-85-025] N87-11655
ROCKS
Microwave dielectric properties of minerals and rocks N87-11289
Spectral study of rocks and some iron deposits from Eastern China N87-11308
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
Spectral features of rocks and minerals from Beiyunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333
ROSAT MISSION
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's) [MPE-PREPRINT-33] N87-11648
The position sensitive proportional counter (PSPC) of the ROSAT telescope [MPE-PREPRINT-32] N87-11649
ROTARY GYROSCOPES
Development and test of a miniaturized fiber-optic gyroscope [BMFT-FB-W-85-033] N87-11148
Analog fiber gyro with extended linear range [2339212320] N87-11152
ROTARY STABILITY
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis [NASA-CR-3606] N87-10836
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg [NASA-CR-3747] N87-10837
ROTARY WINGS
Parametric analysis of a passive cyclic control device for helicopters [NASA-CR-166606] N87-10862
ROTATING BODIES
Extension of the Ritz method to the forced, damped vibrations of rotating structural elements N87-11234
ROTATING CYLINDERS
Finite length effects in Taylor-Couette flow [NASA-CR-178175] N87-11125
ROTATING LIQUIDS
Finite length effects in Taylor-Couette flow [NASA-CR-178175] N87-11125
ROTOR BLADES (TURBOMACHINERY)
The high speed cascade wind tunnel: Still an important test facility for investigations on turbomachinery blades [DFVLR-MITT-86-11] N87-10878
Turbine Engine Hot Section Technology, 1984 [NASA-CP-2339] N87-11180
Turbine airfoil deposition models N87-11191
ROTORS
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation [NASA-TP-2375] N87-10841
RUNGE-KUTTA METHOD
Diagonally implicit Runge-Kutta methods for parabolic equations in conservation law form [PREPRINT-980] N87-11552
The order of B-convergence of algebraically stable Runge-Kutta methods [CWI-NM-R8607] N87-11562
RUNWAYS
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas [NASA-CR-4024] N87-10854
RURAL AREAS
Analysis of multilevel measurements of spectral signatures for less-favored areas — agriculture, land use N87-11301
RURAL LAND USE
Analysis of multilevel measurements of spectral signatures for less-favored areas — agriculture, land use N87-11301

S

SAFETY
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B [AD-A169381] N87-10855
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11088
SAFETY FACTORS
National Transportation Safety Board safety recommendation N87-10852
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
Safety considerations for fabricating lithium battery packs N87-11079
Test results of JPL LiSOCl sub 2 cells N87-11081
Orwellian programming in safety-critical systems [RSRE-MEMO-3924] N87-11499
SALINITY
Long-term climate change in observed physical properties of the oceans [DE86-009706] N87-11468
SATELLITE ANTENNAS
Tele-X antenna module structure qualification program N87-10924
Offset unfurlable antenna. Phase 2A: Executive summary — Intelsat, M-Sat [MBB-R-0200/3069-R] N87-11066
SATELLITE DESIGN
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures — vibration effects N87-10887
The design analysis and verification of a satellite N87-10916
Structural concept of Japanese advanced geostationary spacecraft N87-10920
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design [CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating [CERT-4193-VOL-2] N87-10950
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings [CERT-4193-VOL-3] N87-10951
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings [CERT-4193-VOL-4] N87-10952
Electrostatic discharge effects on satellite electronic devices [MATRA-CMT-138-JPG-078-85] N87-10953
Improving radiation/contamination tests — satellite coating degradation [CERT-419300/1-DERTS] N87-10954
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns [ESA-CR(P)-2254] N87-11363
SATELLITE IMAGERY
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270
Imaging spectrometry: Past, present, future N87-11274
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293

A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
Contribution of internal waves to spectral signatures N87-11331
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data [DE86-008904] N87-11337
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366
Operational evaluation of METEOSAT data N87-11455
Report of the Workshop on Global Large-Scale Precipitation Data Sets for the World Climate Research Programme [WCP-111] N87-11472

SATELLITE NAVIGATION SYSTEMS
GRANAS: Global Radio Navigation System [BMFT-FB-W-85-034] N87-10857

SATELLITE OBSERVATION
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns [ESA-CR(P)-2254] N87-11363
Accuracy analysis of satellite experiments for the measurement of the radiation budget N87-11379
The response of the tropical atmosphere to the extraordinary El Nino sea surface temperature anomaly 1982-1983: Observation N87-11406
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426
Satellite observations of atmospherically determined changes of the ocean surface temperature — hurricanes N87-11427
Operational evaluation of METEOSAT data N87-11455
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462
Active plasma experiments — Active Magnetic Particle Tracer Explorers (AMPTE) project [MPE-PREPRINT-43] N87-11603

SATELLITE SOUNDING
Downward long-wave irradiance at the ocean surface using satellite data N87-11303

SATELLITE TRANSMISSION
Development of equipment for the 20/30 GHz payload of a satellite for propagation and transmission experiments [BMFT-FB-W-85-035] N87-10948

SATELLITE-BORNE INSTRUMENTS
Sub-millimetre (far-IR) heterodyne spectrometer assembly — spaceborne platforms [CD.6500689] N87-10958
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11298
Report of the COSPAR International Workshop on Satellite-Derived Sea Surface Temperatures for Global Climate Applications [WCP-110] N87-11471
Gamma ray astronomy from satellites and balloons [MPE-PREPRINT-39] N87-11650

SATELLITE-BORNE PHOTOGRAPHY
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462

SATELLITE-BORNE RADAR
Design, definition, and manufacture participation for the SAR Electronic Power Convertar (EPC) breadboard — spaceborne radar [ESA-CR(P)-2249] N87-11116

SATELLITES
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906

SATURN RINGS
Resonance capture and Saturn's rings [DE86-011733] N87-11674

SAUDI ARABIA
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311

SCALARS
The interface with decision makers and some experimental results in interactive multiple objective programming methods [REPT-85-36] N87-11628

SCALE EFFECT
Scale-dependent models for climatology N87-11396

SCALE MODELS
Backscatter measurements from simulated vegetation structures N87-11254

SCALING LAWS
The scaling of two phase flow [MEAH-64] N87-11139
Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom [NOTA-INTERNA-859] N87-11564
Scaling violation in hadronic interactions and the deep underground flux of cosmic muons — particle collision experiment [PREPRINT-495] N87-11682

SCATTERING
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering [DE86-007857] N87-11612

SCATTERING COEFFICIENTS
Scattering models for coniferous and deciduous vegetation N87-11263
Microwave scattering loss of dry snow N87-11288

SCATTERING FUNCTIONS
A translation property in rough surface scattering N87-11258

SCATTEROMETERS
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns — ocean backscattering N87-11240
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Analysis and calibration of the Dutch scatterometer measurements N87-11246
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Analysis of airborne measurements of the marine boundary layer during the TOSCANE experiment — scatterometry N87-11250
Analysis of the ESA wind scatterometer campaign data N87-11251
The C and Ku band scatterometer results from Canadian participation in the ESA PROMESS ocean measurement campaign N87-11252

SCENE ANALYSIS
THe effects of terrain clutter on observer behaviour during search of complex scenery [BAE-BT-13535] N87-11484

SCHWARZSCHILD METRIC
Vacuum polarization on black hole spacetimes N87-11668

SCORPIUS CONSTELLATION
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star [MPE-PREPRINT-44] N87-11661
Bimodal quasi-oscillatory and spectral behavior in Sco X-1 [MPE-PREPRINT-45] N87-11662
Search for orbital X-ray variation in Sco X-1 [MPE-PREPRINT-51] N87-11679

SEA ICE
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
Physical processes in the atmospheric boundary layer at the pack-ice border N87-11394

SEA LEVEL
Long-term climate change in observed physical properties of the oceans [DE86-009706] N87-11468

SEA SURFACE TEMPERATURE
The response of the global atmosphere to the extraordinary El Nino sea surface temperature anomaly in January 1983: Simulation N87-11405
The response of the tropical atmosphere to the extraordinary El Nino sea surface temperature anomaly 1982-1983: Observation N87-11406
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Satellite observations of atmospherically determined changes of the ocean surface temperature — hurricanes N87-11427
Analysis of mesoscale temperature and turbidity field — ocean surface layer N87-11457
The variability of sea surface temperatures N87-11460
Report of the COSPAR International Workshop on Satellite-Derived Sea Surface Temperatures for Global Climate Applications [WCP-110] N87-11471

SEA WATER
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423

SEARCHING
Research in the area of visual search [AD-A168923] N87-11483

SEARCHLIGHTS
An infrared searchlight [FOA-C-30421-E4] N87-11602

SEASAT SATELLITES
Study of the performances of SEASAT satellite over ice and sea ice [CNES-CS/MM/82/117/CT/GRGS] N87-10955

SECULAR VARIATIONS
Statistical analysis of secular temperature series N87-11376

SEDIMENTARY ROCKS
Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312

SEDIMENTS
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283

SELECTION
Computer aided education in the choce of studies [REPT-85-29] N87-11528

SELF ADAPTIVE CONTROL SYSTEMS
A multivariable self-tuning controller with integral action [REPT-86-002] N87-11539

SELF OSCILLATION
Some calculations based on a mathematical model for fluid flow through a collapsible tube [REPT-84-41] N87-11138

SEMICONDUCTOR DEVICES
Radiation hardness assurance of electronic components, with special reference to semiconductor devices and evaluation statistics [BAE-BT-13801] N87-11113
Radiation upset threshold detector apparatus [AD-D012260] N87-11145
An infrared searchlight [FOA-C-30421-E4] N87-11602

SEMICONDUCTOR JUNCTIONS
Fabricating high-concentration GaAs cell photovoltaic modules [DE86-011705] N87-11351

SEMICONDUCTOR LASERS
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031

SENEGAL
Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325

SEPARATED FLOW
Unsteady airload computations for airfoils oscillating in attached and separated compressible flow [NLR-MP-85040-U] N87-10846
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
Advanced method for computing the flow around wings with rear separation and ground effect [DFVLR-FB-86-17] N87-11017
Visualization of three-dimensional forced unsteady separated flow [AD-A168939] N87-11129

SEPARATORS
Qualification testing of general electric 50 Ah nickel-cadmium cells with new separator and new positive plate processing N87-11084
Aerospace nickel-cadmium cell separator qualifications program N87-11085
An advanced Ni-Cd battery cell design N87-11087

SERVOCONTROL
Performance characteristics of a low speed hydraulic motor driving a position control system [BAE-BT-14976] N87-11166
Image based visual servo control of a revolute-coordinate (arm and elbow) robot [RR-288] N87-11169

SERVOMOTORS
Performance characteristics of a low speed hydraulic motor driving a position control system [BAE-BT-14978] N87-11168

SET THEORY
On restrictions of projections along separable metric spaces [REPT-85-42] N87-11571

SHALLOW WATER
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121

SHAPED CHARGES
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods [AD-A168186] N87-11160

SHAPES
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844
SHEAR LAYERS
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes
[DFVLR-FB-86-10] N87-11136
SHEAR PROPERTIES
Electro-rheological fluids. A brief description and typical applications
[BAE-BT-13744] N87-11132
SHELLS (STRUCTURAL FORMS)
Conduction investigations into the magnetic properties of matter
[NASA-CR-179868] N87-11126
SHIPS
Study of the status and potential of high energy beam welding in shipyard construction
[AD-A169281] N87-11161
Time series analysis and composite analysis of equatorial observations from ships N87-11377
SHORT WAVE RADIATION
Heating of the atmosphere by particle absorption short wavelength radiation N87-11391
SHUTTLE IMAGING RADAR
Digital combination of SAR and (MSS) optical data for identification of spectral signatures — SIR-A N87-11329
SHUTTLE PALLET SATELLITES
Technology demonstration programme, phase 2 study — STS half pallets
[BAE-TP-8207] N87-10885
SIEVES
Multiprocessing the Sieve of Eratosthenes
[NASA-CR-178131] N87-11509
SIGNAL ANALYSIS
Spectral analysis for radar using linear predictive filtering
[RSRE-MEMO-3896] N87-11022
SIGNAL ANALYZERS
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
Objectives and first results of the NASA SETI sky survey field tests at Goldstone N87-11054
SIGNAL DETECTION
Design of control laws for adaptive signal tracking systems N87-10882
SIGNAL GENERATORS
Automated measurement of frequency response of frequency-modulated generators using the Bessel null method
[PB86-202991] N87-11150
SIGNAL PROCESSING
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035
A method to dramatically improve subcarrier tracking N87-11036
A new method for frame synchronization N87-11037
Cramer-Rao bounds for signal-to-noise ratio and combiner weight estimation N87-11038
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
Deep space network Mark 4A description N87-11051
Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer
[NASA-TM-89005] N87-11105
La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October
[ESA-TT-964] N87-11131
Signal processing and interpretation using multilevel signal abstractions
[AD-A169166] N87-11513
Optical filtering techniques
[AD-A168084] N87-11596
SIGNAL RECEPTION
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Guassian noise channel N87-11034
News about the visibility of signal lights under the influence of the atmosphere N87-11454
SIGNAL REFLECTION
Wavelength selective demultiplexer tuner
[AD-D012264] N87-11106
SIGNAL TO NOISE RATIOS
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035
A method to dramatically improve subcarrier tracking N87-11036
Cramer-Rao bounds for signal-to-noise ratio and combiner weight estimation N87-11038
SIGNAL TRANSMISSION
Analysis of directional coupler signals in an overmoded waveguide system — plasma heating systems
[IPF-85-2] N87-11067
SIGNATURE ANALYSIS
The physical and physiological interpretation of vegetation spectral signatures N87-11272
SILICON
Silicon wafer cleaning for integrated circuit fabrication
[RSRE-MEMO-3907] N87-11071
Investigation of high-efficiency silicon concentrator cells
[DE86-011914] N87-11350
Stress and efficiency studies in EFG
[NASA-CR-179814] N87-11618
SILICON CARBIDES
Whisker-reinforced ceramic composites
[DE86-011058] N87-10980
Strain contrast in SiC whisker reinforced Al sub 2 O sub 3
[DE86-009537] N87-10981
Processing of laser formed SiC powder
[NASA-CR-179857] N87-11009
Automotive Technology Development Program
[DE86-010683] N87-11163
SILICON DIOXIDE
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
SIMULATION
Research Issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985
[AD-A169268] N87-11062
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
NOAA 26.5 Ah LEO characterization test N87-11093
Nickel hydrogen low Earth orbit life testing N87-11102
Simulation of multitemporal SAR images N87-11256
WEST-3 wind turbine simulator development. Volume 1: Summary
[NASA-CR-174981] N87-11348
SIMULATORS
Prop-fan slipstream effects using static simulators: Low speed task, phase 1
[BAE-B59R/R-D/610/13498] N87-10875
SINGLE CRYSTALS
The growth of fatigue cracks in a nickel base single crystal
[PNR-90310] N87-11001
Cost effective single crystals — gas turbine components
[PNR-90319] N87-11615
Development of single crystal alloys for specific engine applications
[PNR-90320] N87-11616
SITE SELECTION
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591
SIZING MATERIALS
The interface between fiber and matrix resin from a chemical point of view N87-10970
SKIN FRICTION
Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end
[NASA-TP-2352] N87-10838
SLENDER WINGS
Advanced method for computing the flow around wings with rear separation and ground effect
[DFVLR-FB-86-17] N87-11017
SLURRIES
Electro-rheological fluids. A brief description and typical applications
[BAE-BT-13744] N87-11132
SMOG
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451
SNOW
Microwave modeling of snow and soil N87-11255
Reflectivity contrast of forested slopes with snow-covered ground N87-11271
Can microwave signatures be used to retrieve the water equivalent of a dry snow pack? N87-11286
Microwave scattering loss of dry snow N87-11288
Spectral signature of snow in visible and near-infrared wavelengths N87-11316
Snow studies: Study journey to Switzerland, January 1986
[FOA-C-30419-E1,E3] N87-11341
SOCIAL FACTORS
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
SODAR
Evolution of sodar echoes as a climatological characteristic of the boundary layer N87-11459
SODIUM SULFUR BATTERIES
Sodium-sulfur batteries for spacecraft energy storage N87-11074
SOFTWARE ENGINEERING
The use of values without names in a programming support environment — Flex programming support environment
[RSRE-MEMO-3901] N87-11498
A proposal for a new software reliability model and its preliminary assessment
[REPT-86-001] N87-11519
Software tools for the design of protocol systems, part 1
[INF-85-21] N87-11523
Design and implementation of the TUBA application generation system
[INF-85-23] N87-11524
SOFTWARE TOOLS
The use of values without names in a programming support environment — Flex programming support environment
[RSRE-MEMO-3901] N87-11498
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507
Software tools for the design of protocol systems, part 1
[INF-85-21] N87-11523
Design and implementation of the TUBA application generation system
[INF-85-23] N87-11524
A modeling approach to information system development
[INF-85-29] N87-11635
SOIL MAPPING
Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323
SOIL MOISTURE
Relation between soil moisture tension and spectral reflectance of different soil in visible and near-infrared range N87-11314
A comparison of several models for the calculation of ground temperature and ground moisture N87-11389
SOILS
Microwave modeling of snow and soil N87-11255
Reconstruction of vegetation spectra from soil plant canopies N87-11288
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method — soil emissivity; laser scattering N87-11279
Radiometric data characterize quantization of soil forming minerals N87-11281
Calibrated microwave signature measurements of soil and wheat N87-11299
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
SOLAR ACTIVITY
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data
[PB86-213865] N87-11365
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677
SOLAR ARRAYS
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
HPSA: High Power Solar Array study — Columbus space station
[BAE-TP-8071] N87-11352
SOLAR ATMOSPHERE
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677
SOLAR BLANKETS
The effect of the non-uniform stress distribution in the blankets of single and twin boom solar array panels upon their modal characteristics N87-10904

SOLAR CELLS
Physical metallurgy issues in solder joint performance
[DE86-010961] N87-10999
Investigation of high-efficiency silicon concentrator cells
[DE86-011914] N87-11350
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351
SOLAR COLLECTORS
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351
SOLAR CORONA
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677
SOLAR DYNAMIC POWER SYSTEMS
Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit
[NASA-TM-88865] N87-10960
SOLAR ENERGY CONVERSION
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343
SOLAR FLARES
Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea
[PB86-213873] N87-11364
SOLAR FLUX DENSITY
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179663] N87-11672
SOLAR GENERATORS
Development of a lightened structure for the GSR3 solar generator N87-10927
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349
SOLAR PROMINENCES
Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea
[PB86-213873] N87-11364
SOLAR RADIATION
Solar radiation transport in realistic atmospheres with 3-dimensional cloud fields N87-11412
Small scale and short term variability of global radiation in the Federal Republic of Germany N87-11440
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462
Data bases for isolating the effects of the increasing carbon dioxide concentration
[DE86-009709] N87-11469
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179663] N87-11672
SOLAR RADIO BURSTS
Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea
[PB86-213873] N87-11364
X-ray bursts from GX 17+2: A new approach
[MPE-PREPRINT-48] N87-11678
SOLAR SPECTRA
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293
SOLAR TERRESTRIAL INTERACTIONS
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676
SOLDERED JOINTS
Physical metallurgy issues in solder joint performance
[DE86-010961] N87-10999
SOLID ELECTROLYTES
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells
[DE86-011563] N87-11112
SOLID MECHANICS
Current problems in solid dynamics
[DE86-011653] N87-11229
SOLID PROPELLANT ROCKET ENGINES
Structural behavior of the space shuttle SRM Tang-Clevis joint
[NASA-TM-89018] N87-11177
SOLID STATE
Chemical reaction in shock compression of solids
[DE86-003502] N87-11611
SOLIDS
Calculating and predicting the properties of materials
[DE86-011557] N87-10964
Chemical reaction in shock compression of solids
[DE86-003502] N87-11611
SOLVENTS
A new readily processable polyimide
[NASA-TM-89253] N87-11008
SOUND PROPAGATION
Sound propagation over uneven ground and irregular topography
[NASA-CR-179827] N87-11575
SOUND WAVES
Acoustic radiation and internal dissipation in honeycomb panels N87-10909
SPACE COMMERCIALIZATION
NASA Space Program
[S-HRG-99-691] N87-11642
SPACE DEBRIS
Protection of spacecraft from meteoroids and orbital debris
[DE86-009996] N87-10947
SPACE ENVIRONMENT SIMULATION
A method of studying the behavior of composite materials in simulated space environments N87-10940
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design
[CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating
[CERT-4193-VOL-2] N87-10950
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings
[CERT-4193-VOL-4] N87-10952
Improving radiation/contamination tests — satellite coating degradation
[CERT-419300/1-DERTS] N87-10954
SPACE ERECTABLE STRUCTURES
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10925
SPACE EXPLORATION
Status of advanced propulsion for space based orbital transfer vehicle
[NASA-TM-88848] N87-10959
SPACE FLIGHT
National Aeronautics and Space Administration Authorization Act, 1987
[H-REPT-99-829] N87-11640
SPACE NAVIGATION
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
HEO multimission navigation concept N87-11052
SPACE PLASMAS
Diamagnetic effect and anomalous transport in expanding plasma clouds — Active Magnetic Particle Tracer Explorer (AMPTE) satellite experiment simulations
[MPE-PREPRINT-26] N87-11647
Types and properties of planetary tori and limit on mass loss from satellites N87-11666
A space radiation test model study
[AD-A169412] N87-11681
SPACE POWER REACTORS
Simulation of the preliminary General Electric SP-100 space reactor concept using the ATHENA computer code
[DE86-005324] N87-11590
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591
SPACE SHUTTLE ORBITERS
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884
Acoustic load considerations for spacecraft structures — Space Shuttle N87-10905
SPACE SHUTTLE PAYLOADS
Space shuttle payload design and development N87-10888
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10893
Impact of shuttle environment on prelaunch handling of nickel-hydrogen batteries N87-11099
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296
SPACE SHUTTLES
Proposed input for determining longitudinal aerodynamic parameters for the space shuttle
[NASA-TM-85758] N87-10869
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884
Investigation of the coupling of the Hermes vehicle to the Ariane 5 launcher N87-10937
SPACE STATION POWER SUPPLIES
Energy storage systems comparison for the space station N87-11075
Nickel-hydrogen batteries from Intelsat 5 to space station N87-11101
SPACE STATIONS
Control of a free-flying robot manipulator system
[NASA-CR-179877] N87-11159
SPACE TRANSPORTATION SYSTEM
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884
SPACEBORNE ASTRONOMY
Gamma ray astronomy from satellites and balloons
[MPE-PREPRINT-39] N87-11650
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures — ISO mission
[RPT/CRY/62351/BO] N87-11654
SPACEBORNE EXPERIMENTS
Study on a drop and bubble unit. Volume 1: Executive study — spaceborne experiments
[ESA-CR(P)-2256] N87-10881
SPACEBORNE PHOTOGRAPHY
Remote sensing in hydrology — aerial photography
[ICW-1687] N87-11340
SPACEBORNE TELESCOPES
Structural development of the telescope structure of the HIPPARCOS satellite payload N87-10929
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE-PREPRINT-33] N87-11648
The position sensitive proportional counter (PSPC) of the ROSAT telescope
[MPE-PREPRINT-32] N87-11649
SPACECRAFT ANTENNAS
Kinematic analysis of a large deployable truss antenna — spacecraft antenna N87-10941
SPACECRAFT CHARGING
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946
Electrostatic discharge effects on satellite electronic devices
[MATRA-CMT-138-JPG-078-85] N87-10953
SPACECRAFT COMMUNICATION
The Telecommunications and Data Acquisition Report — Deep Space Network
[NASA-CR-179715] N87-11024
Deep space network Mark 4A description N87-11051
SPACECRAFT CONFIGURATIONS
Investigation of the coupling of the Hermes vehicle to the Ariane 5 launcher N87-10937
SPACECRAFT CONSTRUCTION MATERIALS
Space technologies and materials: A look back and future perspectives N87-10934
A method of studying the behavior of composite materials in simulated space environments N87-10940
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994
SPACECRAFT CONTAMINATION
Experimental verification of rocket exhaust plumes and impingement effects on spacecraft surfaces
[DFVLR-IB-22-85-A-29] N87-10961
SPACECRAFT CONTROL
Proceedings of the 2nd Annual SCOLE Workshop
[NASA-TM-89048] N87-10945
Modern control of large flexible spacecraft, ESA ASTP study
[BL-6206-ISSUE-2] N87-10956
SPACECRAFT DESIGN
Spacecraft load, design and test philosophies N87-10922
Engineering and software interfacing for thermal, structural and attitude control related with spacecraft N87-10928
SPACECRAFT ELECTRONIC EQUIPMENT
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE-PREPRINT-33] N87-11648
SPACECRAFT LAUNCHING
Feasibility study of a launcher vibration environment simulator N87-10918
SPACECRAFT MODELS
Demonstration of modal synthesis on an experimental structure and its application to large spacecraft N87-10912

Analysis/test correlation and update of dynamic mathematical models — spacecraft structures N87-10913
Applying modal survey test results for updating dynamic mathematical models of spacecraft structures N87-10914
Experience on the Olympus modal survey test N87-10919
Large flexible space structures: Some simple models [TW-269] N87-10957

SPACECRAFT POWER SUPPLIES
Protection of spacecraft from meteoroids and orbital debris [DE86-009996] N87-10947
Sodium-sulfur batteries for spacecraft energy storage N87-11074
Galileo Li/SO sub 2 battery modules program update N87-11075
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
Qualification testing of general electric 50 Ah nickel-cadmium cells with new separator and new positive plate processing N87-11084
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Satellite battery testing status N87-11091
Voltage-temperature charge verification testing of 34 ampere-hour nickel-cadmium cells N87-11092
A high reliability battery management system N87-11094
Recent advances in Ni-H2 technology at NASA Lewis Research Center N87-11095
Lightweight, direct-radiating nickel hydrogen batteries N87-11096
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Nickel-hydrogen low-Earth-orbit test program N87-11098
Impact of shuttle environment on prelaunch handling of nickel-hydrogen batteries N87-11099
Nickel-hydrogen batteries from Intelsat 5 to space station N87-11101
Nickel hydrogen low Earth orbit life testing N87-11102
The 4.5 inch diameter IPV Ni-H2 cell development program N87-11103
HPSA: High Power Solar Array study — Columbus space station [BAE-TP-8071] N87-11352

SPACECRAFT SHIELDING
Protection of spacecraft from meteoroids and orbital debris [DE86-009996] N87-10947

SPACECRAFT STABILITY
Modern control of large flexible spacecraft, ESA ASTP study [BL-6206-ISSUE-2] N87-10956

SPACECRAFT STRUCTURES
Proceedings of an International Conference on Spacecraft Structures [ESA-SP-238] N87-10886
Design and verification activities and requirements for spacecraft structures N87-10890
On optimal passive and active control of precision spacecraft structures N87-10891
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Damping representation related to spacecraft structural design N87-10898
Fluid-structure interaction: Modal synthesis method — spacecraft structures N87-10899
Acoustic load considerations for spacecraft structures — Space Shuttle N87-10905
Transient external loads or interface forces reconstructed from structural response measurements — modular spacecraft N87-10910
Structural system identification using single and multiaxial vibration test data — spacecraft structures N87-10911
Applying modal survey test results for updating dynamic mathematical models of spacecraft structures N87-10914
A review of time domain modal test methods and applications — space structures N87-10915
Reliability and economics of spacecraft structure development N87-10921
Spacecraft load, design and test philosophies N87-10922
Tele-X antenna module structure qualification program N87-10924
Loads analysis for the Galileo spacecraft N87-10926
Development of a lightened structure for the GSR3 solar generator N87-10927
Critical element concepts for composite structures N87-10930
Kinematic analysis of a large deployable truss antenna — spacecraft antenna N87-10941
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942
Spacecraft structural acoustics: Progress in vibration level prediction N87-10943
Composites design handbook for space structure applications. Executive summary [ESA-CR(P)-2196] N87-10982
A new readily processable polyimide [NASA-TM-89253] N87-11008

SPACECRAFT TRACKING
The Telecommunications and Data Acquisition Report — Deep Space Network [NASA-CR-179715] N87-11024
HEO multimission navigation concept N87-11052
ICE navigation support N87-11053

SPACELAB PAYLOADS
Technology demonstration programme, phase 2 study — STS half pallets [BAE-TP-8207] N87-10885
Bubble Drop and Particle Unit (BDPU) project — ESA microgravity program [BO-RP-AI-004] N87-11016

SPARE PARTS
Data management: DoD should redirect its efforts to automate technical data depositories [AD-A168095] N87-11629

SPATIAL DISTRIBUTION
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985 [AD-A168046] N87-11677

SPECIFIC HEAT
Effective Landau theory for disordered interacting electron systems: Specific heat behavior [PREPRINT-500] N87-11617

SPECTRAL EMISSION
Molecular clouds associated with young open star clusters N87-11659

SPECTRAL METHODS
Some recent developments in spectral methods [NASA-CR-178178] N87-11127

SPECTRAL REFLECTANCE
Relation between soil moisture tension and spectral reflectance of different soil in visible and near-infrared range N87-11314
Spectral measurements for estimation of biomass on limestone grassland N87-11319
Investigation of spectral reflectance signatures on forest damages using multispectral data N87-11320
Reflectance properties of conifers, measured from a helicopter N87-11321
Reflectance properties of barley for different agronomical treatments N87-11326
Nutritional diagnosis for plant by field spectroradiometer — sugar beets N87-11328
Spectral measurements of tree defoliation N87-11330
Laboratory measurements of spectral reflectance (0.4 to 2.3 micron) of basalts N87-11332
Spectral features of rocks and minerals from Bayunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333

SPECTRAL RESOLUTION
High-spectral resolution remote sensing instruments developed and under development at CNES N87-11276
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278

SPECTRAL SENSITIVITY
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics [AD-A169175] N87-11572

SPECTRAL SIGNATURES
Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing — conference [ESA-SP-247] N87-11238
The physical and physiological interpretation of vegetation spectral signatures N87-11272
Spectral signatures of coastal objects N87-11282
Can microwave signatures be used to retrieve the water equivalent of a dry snow pack? N87-11286
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296
Calibrated microwave signature measurements of soil and wheat N87-11299
Analysis of multilevel measurements of spectral signatures for less-favored areas — agriculture, land use N87-11301
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield — Thematic Mapper (TM) N87-11311
Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312
Spectral signature of snow in visible and near-infrared wavelengths N87-11316
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
Spectral signatures and mapping of mineral deposits of south Morocco — Landsat multispectral scanner N87-11323
Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325
Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327
Digital combination of SAR and (MSS) optical data for identification of spectral signatures — SIR-A N87-11329
Contribution of internal waves to spectral signatures N87-11331
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334

SPECTRAL THEORY
Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations [PREPRINT-497] N87-11546
Analysis of the dispersion force between a layered sphere and a cylinder [AD-A169444] N87-11621

SPECTROMETERS
Imaging spectrometry: Past, present, future N87-11274
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
The CO2 laser imaging spectroscopy for Earth observation N87-11285

SPECTROPHOTOMETRY
Spectral features of rocks and minerals from Bayunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333

SPECTRORADIOMETERS
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270
High-spectral resolution remote sensing instruments developed and under development at CNES N87-11276
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278
Airborne measurements of the spectral reflectance of freshwater ice N87-11280
Radiometric data characterize quantization of soil forming minerals N87-11281
Spectral signatures of coastal objects N87-11282
Analysis of multilevel measurements of spectral signatures for less-favored areas — agriculture, land use N87-11301
An atmospheric correction method using Guzzi-spectroradiometer input data N87-11305
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313
Ground level radiometric monitoring of rainy season food crops in the Sahel N87-11317
Reflectance properties of conifers, measured from a helicopter N87-11321
Nutritional diagnosis for plant by field spectroradiometer — sugar beets N87-11328

SPECTROSCOPY
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects [NASA-CR-179833] N87-11142

SPECTRUM ANALYSIS
Spectral analysis for radar using linear predictive filtering [RSRE-MEMO-3896] N87-11022
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
Reconstruction of vegetation spectra from soil plant canopies N87-11268
Spectral study of rocks and some iron deposits from Eastern China N87-11308
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Far-infrared spectral studies from the G. P. Kuiper Airborne Observatory [NASA-CR-179879] N87-11652

SPEECH RECOGNITION
Experiments on the annotation of large quantities of speech using the ZIP dynamic time-warping algorithm
[RSRE-MEMO-3919] N87-11023
SPHERES
Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621
SPLITTING
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128
SPOILERS
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
SPOT (FRENCH SATELLITE)
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313
SPRINGS (ELASTIC)
Controlling the temporal structure of limb movements: A response
[AD-A169261] N87-11488
SQUARE WAVES
A method to dramatically improve subcarrier tracking N87-11036
SQUID (DETECTORS)
Radiofrequency amplifier based on a dc superconducting quantum interference device
[AD-D012353] N87-11109
STABILITY
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells
[DE86-011563] N87-11112
Stability of multilayers for short-wavelength optics
[DE86-012129] N87-11598
STABILIZERS (FLUID DYNAMICS)
DC-10 composite vertical stabilizer ground test program
[NASA-CR-3715] N87-10974
STACKS
Develop and test fuel cell powered on-site integrated total energy systems. Phase 3: Full-scale power plant development
[NASA-CR-175117] N87-11346
Develop and test fuel cell powered on site integrated total energy sysems: Phase 3: Full-scale power plant development
[NASA-CR-175075] N87-11347
STANDARDS
Minimum operational performance standards for airborne ILS glide slope receiving equipment operating within the radio frequency range of 328.6-335.4 MHz
[RTCA/DO-192] N87-10853
Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986
[PB86-206364] N87-11021
NBS (National Bureau of Standards) 50 kHz phase angle calibration standard
[PB86-201274] N87-11151
A summary of DO-178A — airborne software certification
[PNR-90294] N87-11518
STANDING WAVES
Study of a discharge produced by a standing surface wave — plasma physics
[LP-213] N87-11609
Electron transport in integral photoemission X-ray standing wave analysis
[USIP-86-03] N87-11614
STAR CLUSTERS
UV observations of blue stragglers and population 2 K dwarfs
[NASA-CR-179665] N87-11653
Molecular clouds associated with young open star clusters N87-11659
STATE ESTIMATION
A recursive solution for a fading memory filter derived from Kalman filter theory N87-11032
An estimator-predictor approach to PLL loop filter design N87-11033
STATIC STABILITY
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
STATISTICAL ANALYSIS
Illustration of wind field time and space statistics during the TOSCANE-T campaign — scatterometry N87-11248
Statistical analysis of secular temperature series N87-11376
Cloud parameterization with a statistical method N87-11401
A statistical method for prediction of pollutant emission N87-11428
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461
On local and nonlocal measures of efficiency — testing and estimation theory
[ISSN-0169-2690] N87-11566
STATISTICAL CORRELATION
Analysis/test correlation and update of dynamic mathematical models — spacecraft structures N87-10913
STATISTICAL DISTRIBUTIONS
A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540
STATISTICAL MECHANICS
Molecular dynamics simulation of rigid molecules
[PREPRINT-494] N87-11587
The dynamically compressed metallic state: Theory
[AD-A169174] N87-11620
An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse
[NOTA-INTERNA-855] N87-11623
STATISTICAL TESTS
Radiation hardness assurance of electronic components, with special reference to semiconductor devices and evaluation statistics
[BAE-BT-13601] N87-11113
STATISTICAL WEATHER FORECASTING
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
STATORS
Turbine airfoil deposition models N87-11191
STEADY STATE
An efficient method for solving the steady Euler equations
[NASA-TM-87329] N87-11543
STEAM
Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels
[NASA-TM-88873] N87-11345
STEELS
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
STEERABLE ANTENNAS
Optical filtering techniques
[AD-A168084] N87-11596
STELLAR CORONAS
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
STELLAR LUMINOSITY
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
STELLAR OSCILLATIONS
Bimodal quasi-oscillatory and spectral behavior in Sco X-1
[MPE-PREPRINT-45] N87-11662
STELLAR RADIATION
Disappearance of periodic X-ray minima in AM Her
[MPE-PREPRINT-52] N87-11680
STELLAR ROTATION
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661
STELLAR SPECTRA
High resolution spectroscopy of RS CVn stars N87-11657
Bimodal quasi-oscillatory and spectral behavior in Sco X-1
[MPE-PREPRINT-45] N87-11662
Neutrinos from gravitational collapse
[DE86-012304] N87-11663
Search for orbital X-ray variation in Sco X-1
[MPE-PREPRINT-51] N87-11679
STELLAR TEMPERATURE
High resolution spectroscopy of RS CVn stars N87-11657
STELLAR WINDS
The interaction of a strong stellar wind with a multiphase interstellar medium N87-11667
STEREOSCOPY
Passive stereoscopic rangefinder
[BAE-BT-12300] N87-11600
STOCHASTIC PROCESSES
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
Climate models with stochastic excitation N87-11398
The internal memory of open hydrodynamic systems N87-11414
Transition to stochasticity in Hamiltonian systems: Some numerical results
[PREPRINT-503] N87-11548
STORAGE STABILITY
Corrosion by polyurethane antistatic foams — microelectronic devices
[MQAD-R-343] N87-10984
STRAIN GAGES
High temperature static strain gage program N87-11188
Evaluation results of the 700 deg C Chinese strain gages N87-11189
Demonstration test of burner liner strain measurements using resistance strain gages N87-11190
STRAIN MEASUREMENT
Strain contrast in SiC whisker reinforced Al sub 2 O sub 3
[DE86-009537] N87-10981
STRAIN RATE
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998
Strain rate dependence of the deformation behavior of polymers at low temperatures
[KFK-4060] N87-11013
STRAITS
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290
STRANDS
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283
STRATEGY
The strategic defense initiative
[AD-A168147] N87-11644
STRATOSPHERE
Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983
[NASA-RP-1172] N87-11358
STRATUS CLOUDS
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384
STRESS ANALYSIS
Performance characteristics of composite materials N87-10935
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
Stress analysis of Pathfinder-2 models
[NASA-CR-172458] N87-11179
Burner liner thermal/structural load modelling N87-11205
The 3D inelastic analysis methods for hot section components N87-11206
STRESS CONCENTRATION
The effect of the non-uniform stress distribution in the blankets of single and twin boom solar array panels upon their modal characteristics N87-10904
La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August
[ESA-TT-960] N87-11019
Identification of creep mechanisms and quantitative description of stress regimes relevant to design — high temperature plants; wrought alloys
[OEFZS-4352] N87-11232
STRESS INTENSITY FACTORS
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Stress analysis of Pathfinder-2 models
[NASA-CR-172458] N87-11179
STRESS-STRAIN RELATIONSHIPS
Fatigue and fracture: Overview N87-11183
Constitutive modeling for isotropic materials N87-11212
STRETCH FORMING
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939
STRING THEORY
Superstrings and geometry of superspace
[DE86-012044] N87-11622
STRIP TRANSMISSION LINES
Printed circuit transmission line transitions
[AD-A169291] N87-11110
STRUCTURAL ANALYSIS
Proceedings of an International Conference on Spacecraft Structures
[ESA-SP-238] N87-10886
Equivalent continuum analyses of large space trusses N87-10894

Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
Performance characteristics of composite materials N87-10935
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching — Gamma Ray Observatory N87-10939
Spacecraft structural acoustics: Progress in vibration level prediction N87-10943
La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August
[ESA-TT-960] N87-11019
Lightweight, direct-radiating nickel hydrogen batteries N87-11096
The 3D inelastic analysis methods for hot section components N87-11206
The 3-D inelastic analysis methods for hot section components (base program) N87-11208
High temperature stress-strain analysis N87-11209
High-temperature constitutive modeling N87-11210
Constitutive modeling for isotropic materials N87-11211
Creep fatigue life prediction for engine hot section materials (isotropic): Two year update N87-11213
Constitutive modeling of inelastic anisotropic material response N87-11216

STRUCTURAL BASINS
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458

STRUCTURAL DESIGN
Proceedings of an International Conference on Spacecraft Structures
[ESA-SP-238] N87-10886
Space shuttle payload design and development N87-10888
About the development of interactive shell design codes N87-10889
Design and verification activities and requirements for spacecraft structures N87-10890
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Damping representation related to spacecraft structural design N87-10896
Structural concept of Japanese advanced geostationary spacecraft N87-10920
Spacecraft load, design and test philosophies N87-10922
Development of deployable truss concept for space station N87-10923
Structural development of the telescope structure of the HIPPARCOS satellite payload N87-10929
Composites design handbook for space structure applications. Executive summary
[ESA-CR(P)-2196] N87-10982
Galileo Li/SO sub 2 battery modules program update N87-11076
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080
Test results of JPL LiSOCl sub 2 cells N87-11081
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
A flooded-starved design for nickel-cadmium cells N87-11086
An advanced Ni-Cd battery cell design N87-11087
The 4.5 inch diameter IPV Ni-H2 cell development program N87-11103

STRUCTURAL DESIGN CRITERIA
Space shuttle payload design and development N87-10888
Optimization of axially compressed CFRP cylinders — spacecraft structures N87-10942
NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073
Energy storage systems comparison for the space station N87-11075
Determining the influence and effects of manufacturing variables on sulfur dioxide cells N87-11077
Safety considerations for fabricating lithium battery packs N87-11079
Lightweight, direct-radiating nickel hydrogen batteries N87-11096
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Nickel-hydrogen batteries from Intelsat 5 to space station N87-11101
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343

STRUCTURAL FAILURE
Material selection for carbon fiber reinforced composite structures — conferences
[ESA-TT-950] N87-10965

STRUCTURAL MEMBERS
Extension of the Ritz method to the forced, damped vibrations of rotating structural elements N87-11234

STRUCTURAL STABILITY
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028

STRUCTURAL VIBRATION
Launcher-payload dynamic interaction N87-10900
On a simple vibration control design for large space structure models with uncertain parameters N87-10903
Prediction and correlation of structural response in acoustic chambers — large space structures N87-10907
Structural system identification using single and multiaxial vibration test data — spacecraft structures N87-10911
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028
Passive damping concepts for slender columns in space structures
[NASA-CR-179607] N87-11178

STUDENTS
Graduate engineering research participation in aeronautics
[NASA-CR-179798] N87-10828

SUBSONIC FLOW
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844

SUBSTRATES
Effects of backing plates on the electron exposure of thin polymer films
[NASA-TM-88995] N87-11589

SUCTION
Details of low speed intake test facility at the Warton 2.7m x 2.1m wind tunnel
[BAE-AXM127] N87-10873

SUDDEN IONOSPHERIC DISTURBANCES
Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data
[PB86-213865] N87-11365

SUGAR BEETS
Nutritional diagnosis for plant by field spectroradiometer — sugar beets N87-11328

SULFUR
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179863] N87-11672

SUMMER
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290

SUPERCOMPUTERS
The Array Processor with Emulator (APE) project: A computer for lattice QCD
[NOTA-INTERNA-839] N87-11495
Advances in concurrent computers for autonomous robots
[DE86-008236] N87-11538

SUPERCONDUCTIVITY
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering
[DE86-007857] N87-11612

SUPERCONDUCTORS
Radiofrequency amplifier based on a dc superconducting quantum interference device
[AD-D012353] N87-11109
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering
[DE86-007857] N87-11612

SUPERHIGH FREQUENCIES
Development of equipment for the 20/30 GHz payload of a satellite for propagation and transmission experiments
[BMFT-FB-W-85-035] N87-10948
A prototype DSN X/S-band feed: Model 3 development N87-11027
X-band preamplifier filter N87-11048
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range
[AD-A168083] N87-11059
Varactor tuned X-band FET oscillator
[BAE-BT-14500] N87-11114

SUPERNOVAE
Development of a CCD camera for an automated supernova search and observations of a supernova in NGC 5033 N87-11660

SUPERPLASTICITY
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994

SUPERSATURATION
Nucleation in binary supersaturated gas mixtures
[KFK-4095] N87-11581

SUPERSONIC INLETS
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174676] N87-10835

SUPPORT SYSTEMS
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855

SURFACE DISTORTION
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029

SURFACE FINISHING
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995
Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive
[NASA-TM-89045] N87-11010
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018

SURFACE LAYERS
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424

SURFACE PROPERTIES
The First International Satellite Land-Surface Climatology Project (ISLSCP) Field Experiment (FIFE) N87-11294

SURFACE REACTIONS
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155
Effects of surface chemistry on hot corrosion life N87-11193

SURFACE ROUGHNESS
Sound propagation over uneven ground and irregular topography
[NASA-CR-179827] N87-11575

SURFACE ROUGHNESS EFFECTS
A translation property in rough surface scattering N87-11258

SURFACE TEMPERATURE
Modeling of the relation between air temperature and surface temperature for the spatial extension of surface parameter analysis models N87-11266

SURGES
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946
Radiation upset threshold detector apparatus
[AD-D012260] N87-11145

SURVEILLANCE
Tropical cyclone report, 1985
[AD-A168284] N87-11464

SWEEP FREQUENCY
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035

SWELLING
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967

SWEPT FORWARD WINGS
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861

SWINGBY TECHNIQUE
ICE navigation support N87-11053

SYMMETRY
Finite length effects in Taylor-Couette flow
[NASA-CR-178175] N87-11125

SYNCHROPHASING
An experimental investigation of the interior noise control effects of propeller synchrophasing
[NASA-CR-178185] N87-11577

SYNOPTIC MEASUREMENT
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445

SYNOPTIC METEOROLOGY
Measurement of subscale climatological processes by diagnosis of scaled budgets N87-11381
Climate models with stochastic excitation N87-11398

SYNTAX
Translation and optimization of logic queries: The algebraic approach — data bases
[REPT-86-004] N87-11631

SYNTHESIS (CHEMISTRY)
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987
A new readily processable polyimide
[NASA-TM-89253] N87-11008
Fractal aspects of ceramic synthesis
[DE86-011657] N87-11012

SYNTHETIC APERTURE RADAR
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard --- spaceborne radar
[ESA-CR(P)-2249] N87-11116
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Simulation of multitemporal SAR images N87-11256
Spaceborne SAR depolarisation ambiguities N87-11260

SYSTEM IDENTIFICATION
Structural system identification using single and multiaxial vibration test data --- spacecraft structures N87-10911

SYSTEMS ANALYSIS
Computer program TRAMP: Further extensions --- linear feedback systems analysis program
[BAE-BT-13621] N87-11520
Probabilistic solutions of generalized birth and death equations and application to nonrelativistic electrodynamics
[PREPRINT-483] N87-11625

SYSTEMS ENGINEERING
Analog fiber gyro with extended linear range
[2339212320] N87-11152
Identification of creep mechanisms and quantitative description of stress regimes relevant to design --- high temperature plants; wrought alloys
[OEFZS-4352] N87-11232
Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489

SYSTEMS INTEGRATION
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide
[NASA-CR-178051] N87-11536

SYSTEMS SIMULATION
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313
Computer program TRAMP: Further extensions --- linear feedback systems analysis program
[BAE-BT-13621] N87-11520

T

TAIL ASSEMBLIES
Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end
[NASA-TP-2352] N87-10838
Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90
[NASA-TP-2350] N87-10870

TARGET ACQUISITION
THe effects of terrain clutter on observer behaviour during search of complex scenery
[BAE-BT-13535] N87-11484
Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12489-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12489-VOL-2] N87-11491
Application of the spoke filter to digital IR images --- target identification
[BAE-BT-13988] N87-11601

TAYLOR INSTABILITY
Finite length effects in Taylor-Couette flow
[NASA-CR-178175] N87-11125

TECHNOLOGY ASSESSMENT
Aeronautical facilities assessment
[NASA-RP-1146] N87-10876
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel
[DFVLR-FB-86-23] N87-10879
Technology demonstration programme, phase 2 study --- STS half pallets
[BAE-TP-8207] N87-10885
Evaluation of heater design concepts for hydrazine decomposition chambers
[ESA-CR(P)-2239] N87-10952
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Microwaves and microelectronics
[FOA-C-30426-E] N87-11118
Analysis of multilevel measurements of spectral signatures for less-favored areas --- agriculture, land use N87-11301
An assessment of CD ROM (Compact Disk Read Only Memory)
[AD-A169259] N87-11492
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies
[KFK-PFT-119] N87-11500
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504

TECHNOLOGY TRANSFER
Test results of JPL LiSOCl sub 2 cells N87-11081
Implementation of windmills in Gujarat, India
[ETN-86-97720] N87-11342
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
NASA Space Program
[S-HRG-99-691] N87-11642

TECHNOLOGY UTILIZATION
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2
[ESA-CR(P)-2219] N87-10880
Space technologies and materials: A look back and future perspectives N87-10934
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 1: Executive summary
[NASA-CR-179479] N87-11056
A summary of gas shielded arc welding
[BAE-BT-14107] N87-11167
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
Practical experience with the application of CAD/CAM to a medium-size company N87-11502
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
NASA Space Program
[S-HRG-99-691] N87-11642

TECTONICS
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009896] N87-11360

TELECOMMUNICATION
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 2: Fiber optic technology and long distance networks
[NASA-CR-179480] N87-11057

TELEMETRY
Global positioning system missile test range applications
[DE86-011994] N87-10856
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039

TELEOPERATORS
CESAR research in intelligent machines
[DE86-008226] N87-11494

TELEVISION SYSTEMS
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A168042] N87-11595

TELEVISION TRANSMISSION
Land Mobile Radio/UHF Television Technical Advisory Committee final report in the matter of further sharing of the UHF television band by private land mobile radio services
[PB86-206562] N87-11070

TEMPERATE REGIONS
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441

TEMPERATURE
A comparison of several models for the calculation of ground temperature and ground moisture N87-11389

TEMPERATURE DEPENDENCE
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972

TEMPERATURE DISTRIBUTION
Simulation of the effect of atmospheric trace gases on the global average temperature distribution N87-11403

TEMPERATURE EFFECTS
Performance characteristics of composite materials N87-10935
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
Thermohydrodynamic analysis for laminar lubricating films
[NASA-TM-88845] N87-11124
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179833] N87-11142
The response of the global atmosphere to the extraordinary El Nino sea surface temperature anomaly in January 1983: Simulation N87-11405
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456

TEMPERATURE MEASUREMENT
A fast response thermal conductivity gage
[AD-A168185] N87-11146
Analysis of loop current step response data obtained from in situ tests of temperature detectors
[DE86-011750] N87-11147
Furthur development of the dynamic gas temperature measurement system N87-11185
NASA dilution jet mixing, phase 3 N87-11202
Report of the COSPAR International Workshop on Satellite-Derived Sea Surface Temperatures for Global Climate Applications
[WCP-110] N87-11471

TEMPERATURE MEASURING INSTRUMENTS
Anemothermographic remote sensing using airborne sensors: A new method of micrometeorological cartography N87-11291

TEMPERATURE PROFILES
Measurements in the ground level atmospheric layer during the experiment PUKK --- wind, temperature, and moisture profiles N87-11449

TEMPORAL DISTRIBUTION
A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540

TENSILE PROPERTIES
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936

TERMINAL BALLISTICS
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160

TERRAIN
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430

TERRAIN ANALYSIS
THe effects of terrain clutter on observer behaviour during search of complex scenery
[BAE-BT-13535] N87-11484

TERRESTRIAL DUST BELT
Increase of the dust mass content in the air of Hamburg (West Germany) N87-11450

TEST FACILITIES
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992

TETHERING
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944

TETHERLINES
Guidebook for analysis of tether applications
[NASA-CR-178903] N87-10944

THEMATIC MAPPING
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11298
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309
Spectral signature of snow in visible and near-infrared wavelengths N87-11316
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334
Landsat D Thematic Mapper image dimensionality reduction and geometric correction accuracy [NASA-CR-179875] N87-11336

THEODOLITES
New short-time alignment technique for 70-meter antenna surface panels N87-11026

THEOREMS
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419

THERMAL ANALYSIS
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
Conceptual design of GTA-1 neutralizer cryopump [DE86-011759] N87-11164

THERMAL CONDUCTIVITY GAGES
A fast response thermal conductivity gage [AD-A168185] N87-11146

THERMAL CONTROL COATINGS
Introduction to life modeling of thermal barrier coatings N87-11195
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196
Thermal barrier coating life prediction model development N87-11197
Thermal barrier coating life prediction model development N87-11198
Thermal barrier coating life prediction model development N87-11199

THERMAL CYCLING TESTS
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971

THERMAL ENERGY
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program [DE86-009558] N87-11338

THERMAL ENVIRONMENTS
A fast response thermal conductivity gage [AD-A168185] N87-11146

THERMAL INSULATION
Effective conductivity of aging polyurethane foam [DE86-008939] N87-11011

THERMAL RESISTANCE
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080

THERMAL STABILITY
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11088

THERMAL STRESSES
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933

THERMOCOUPLES
Furthur development of the dynamic gas temperature measurement system N87-11185

THERMODYNAMIC PROPERTIES
Material selection for carbon fiber reinforced composite structures --- conferences [ESA-TT-950] N87-10965
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints [AD-A169346] N87-11476
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3 [NASA-CR-179836] N87-11619

THERMODYNAMICS
The dynamically compressed metallic state: Theory [AD-A169174] N87-11620

THERMOMECHANICAL TREATMENT
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples [ETN-86-97826] N87-11170

THERMOMETERS
Analysis of loop current step response data obtained from in situ tests of temperature detectors [DE86-011750] N87-11147

THERMOPLASTIC RESINS
The crystallization of tough thermoplastic resins in the presence of carbon fibers [NASA-CR-179810] N87-11006
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties [NASA-CR-177058] N87-11007

THERMOSETTING RESINS
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties [NASA-CR-177058] N87-11007
A new readily processable polyimide [NASA-TM-89253] N87-11008

THESAURI
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4 [NASA-CR-179706] N87-10883

THIN FILMS
Thermohydrodynamic analysis for laminar lubricating films [NASA-TM-88645] N87-11124
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering [DE86-007857] N87-11612

THIN PLATES
Effects of backing plates on the electron exposure of thin polymer films [NASA-TM-88995] N87-11589

THIN WALLED SHELLS
About the development of interactive shell design codes N87-10889
Analysis of long thin-walled tubes --- large space structures N87-10895

THREE BODY PROBLEM
Resonance capture and Saturn's rings [DE86-011733] N87-11674

THREE DIMENSIONAL BODIES
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading [NASA-CR-179887] N87-10976

THREE DIMENSIONAL BOUNDARY LAYER
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224

THREE DIMENSIONAL FLOW
Efficiency of various control surfaces in steady and unsteady flow [SNIAS-861-111-101] N87-10872
Three-dimensional unsteady Euler equations solutions on dynamic grids [AD-A168041] N87-11128
Visualization of three-dimensional forced unsteady separated flow [AD-A168939] N87-11129
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes [DFVLR-FB-86-10] N87-11136
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow [NASA-TM-85948] N87-11143
Gas flow environmental and heat transfer nonrotating 3D program N87-11223

THRESHOLD CURRENTS
Radiation upset threshold detector apparatus [AD-D012280] N87-11145

THRESHOLDS (PERCEPTION)
News about the visibility of signal lights under the influence of the atmosphere N87-11454

THRUST CHAMBERS
Improved two-dimensional-kinetics computer program [NASA-CR-179782] N87-11508

THRUST REVERSAL
Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90 [NASA-TP-2350] N87-10870

THRUST VECTOR CONTROL
Performance and quality flight test textbook. Volume 2: Flying qualities [AD-A168124] N87-10830
Static internal performance of single-expansion-ramp nozzles with thrust-vectoring capability up to 60 deg [NASA-TP-2364] N87-10839

TIME
Controlling the temporal structure of limb movements: A response [AD-A169261] N87-11488

TIME DEPENDENCE
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
Linear stability of the hopscotch scheme [CWI-NM-R8603] N87-11560

TIME FUNCTIONS
A review of time domain modal test methods and applications --- space structures N87-10915

TIME SERIES ANALYSIS
Visualization of three-dimensional forced unsteady separated flow [AD-A168939] N87-11129
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
Statistical analysis of secular temperature series N87-11376
Time series analysis and composite analysis of equatorial observations from ships N87-11377
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Interactive data analysis [DFVLR-MITT-86-07] N87-11525

TIMING DEVICES
Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study [NASA-TP-2616] N87-10864

TIP VANES
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation [NASA-TP-2375] N87-10841
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine [IW-R511] N87-10845
Parametric analysis of a passive cyclic control device for helicopters [NASA-CR-166608] N87-10862

TITAN
The ammonia-water phase diagram and its implications for icy satellites [NASA-CR-179881] N87-11671

TITANIUM ALLOYS
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials [DFVLR-FB-86-18] N87-11003

TOLERANCES (MECHANICS)
Stochastic crack propagation with applications to durability and damage tolerance analyses [AD-A168040] N87-11226

TOLERANCES (PHYSIOLOGY)
Effects of long-term radiofrequency radiation on immunological competence and metabolism [AD-A169064] N87-11479

TOPOGRAPHY
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270
Sound propagation over uneven ground and irregular topography [NASA-CR-179827] N87-11575

TORQUE
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star [MPE-PREPRINT-44] N87-11661

TORUSES
Transition to stochasticity in Hamiltonian systems: Some numerical results [PREPRINT-503] N87-11548
Types and properties of planetary tori and limit on mass loss from satellites N87-11666

TOUGHNESS
Toughness and matching extension in graphs [AD-A169177] N87-11544

TRACE CONTAMINANTS
Climate models: Their application in the investigation of trace gases and the impact on climate N87-11397

TRACE ELEMENTS
Simulation of the effect of atmospheric trace gases on the global average temperature distribution N87-11403

TRACKING (POSITION)
Signal processing and interpretation using multilevel signal abstractions [AD-A169166] N87-11513

TRACKING FILTERS
A recursive solution for a fading memory filter derived from Kalman filter theory N87-11032
An estimator-predictor approach to PLL loop filter design N87-11033

TRAILING EDGE FLAPS
Stress analysis of Pathfinder-2 models [NASA-CR-172458] N87-11179

TRAINING EVALUATION
Low-cost avionics simulation for aircrew training [AD-A169198] N87-10865

TRAJECTORY CONTROL
ICE navigation support N87-11053

TRAJECTORY OPTIMIZATION
Energy management of 3-dimensional minimum-time intercept N87-10858

TRANSFER ORBITS
Status of advanced propulsion for space based orbital transfer vehicle
[NASA-TM-88648] N87-10959
TRANSFORMERS
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
TRANSIENT LOADS
Transient external loads or interface forces reconstructed from structural response measurements — modular spacecraft N87-10910
TRANSIENT RESPONSE
Transient external loads or interface forces reconstructed from structural response measurements — modular spacecraft N87-10910
Loads analysis for the Galileo spacecraft N87-10926
TRANSITION PROBABILITIES
Transition to stochasticity in Hamiltonian systems: Some numerical results
[PREPRINT-503] N87-11548
TRANSMISSION EFFICIENCY
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 1: Executive summary
[NASA-CR-179479] N87-11056
TRANSMISSION LINES
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range
[AD-A168083] N87-11059
TRANSMISSION LOSS
Propagation of signals in the frequency band between 30 MHz and 100 MHz
[AD-A169332] N87-11063
TRANSMITTANCE
Tropospheric scatter communication system having angle diversity
[AD-D012263] N87-11058
TRANSONIC FLOW
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation
[NASA-TP-2375] N87-10841
Euler flow solutions for a transonic wind tunnel section
[CWI-NM-R8601] N87-10847
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
TRANSONIC SPEED
Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end
[NASA-TP-2352] N87-10838
TRANSONIC WIND TUNNELS
Euler flow solutions for a transonic wind tunnel section
[CWI-NM-R8601] N87-10847
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861
TRANSPORT AIRCRAFT
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169381] N87-10855
TRANSPORT PROPERTIES
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations
[AD-A168138] N87-10986
TRANSPORT THEORY
A statistical method for prediction of pollutant emission N87-11426
Electron transport in integral photoemission X-ray standing wave analysis
[USIP-86-03] N87-11614
TRAVELING WAVE AMPLIFIERS
Active microwave instrumentation Traveling Wave Tube (TWT) amplifiers: Electrical modes, phase 2
[AMI/2/18] N87-11115
TRAVELING WAVE TUBES
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
TREADMILLS
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482
TREES
Measurements of microwave backscatter from trees N87-11318
TREES (PLANTS)
Spectral measurements of tree defoliation N87-11330
TRENDS
Space technologies and materials: A look back and future perspectives N87-10934
TRIAXIAL STRESSES
Measurement of stress distributions in adhesive bonded joints
[AD-A169176] N87-11227
TRIGGER CIRCUITS
Miniature high performance pulsed modulator apparatus
[AD-D012266] N87-11107
TROPICAL METEOROLOGY
Diagnostic investigations of the intertropical convergent zone N87-11372
TROPICAL REGIONS
Canopy reflectance modeling in a tropical wooded grassland
[NASA-CR-179695] N87-11237
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441
TROPICAL STORMS
Tropical cyclone report, 1985
[AD-A168284] N87-11464
TROPOSPHERE
Variations of the water vapor content in the lower troposphere between 20 deg N and 20 deg S during the last 20 years N87-11368
The response of the tropical atmosphere to the extraordinary El Nino sea surface temperature anomaly 1982-1983: Observation N87-11406
TROPOSPHERIC SCATTERING
Tropospheric scatter communication system having angle diversity
[AD-D012263] N87-11058
TRUNCATION ERRORS
Effective modal parameters and truncation effects in structural dynamics N87-10897
TRUSSES
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Equivalent continuum analyses of large space trusses N87-10894
Development of deployable truss concept for space station N87-10923
Kinematic analysis of a large deployable truss antenna — spacecraft antenna N87-10941
TUBE HEAT EXCHANGERS
Conduction investigations into the magnetic properties of matter
[NASA-CR-179668] N87-11126
TUNERS
Wavelength selective demultiplexer tuner
[AD-D012264] N87-11106
TUNING
A multivariable self-tuning controller with integral action
[REPT-86-002] N87-11539
TURBIDITY
Analysis of mesoscale temperature and turbidity field — ocean surface layer N87-11457
TURBINE BLADES
Development of heat flux sensors in turbine airfoils N87-11186
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196
The 3-D inelastic analysis methods for hot section components (base program) N87-11206
Constitutive modeling for isotropic materials N87-11212
Constitutive modeling of inelastic anisotropic material response N87-11216
Coolant passage heat transfer with rotation, a progress report N87-11225
TURBINE ENGINES
Turbine Engine Hot Section Technology, 1984
[NASA-CP-2339] N87-11180
Combustion overview N87-11181
Fatigue and fracture: Overview N87-11183
Host turbine heat transfer overview N87-11184
Laser anemometers of hot-section applications N87-11187
Effects of surface chemistry on hot corrosion life N87-11193
Introduction to life modeling of thermal barrier coatings N87-11195
Thermal barrier coating life prediction model development N87-11199
The 3D inelastic analysis methods for hot section components N87-11206
Constitutive modeling for isotropic materials N87-11211
TURBINES
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10993
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
TURBOCOMPRESSORS
La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August
[ESA-TT-960] N87-11019
TURBOFAN ENGINES
Coolant passage heat transfer with rotation, a progress report N87-11225
TURBOJET ENGINE CONTROL
Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets — Full Authority Digital Electronic Control (FADEC)
[PNR-90298] N87-10867
TURBULENCE
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179632] N87-11123
Turbulence theory from a present-day point of view N87-11415
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572
European Science Notes, volume 40, number 7
[AD-A168089] N87-11645
TURBULENT BOUNDARY LAYER
Changes in the turbulent boundary layer structure associated with net drag reduction by outer layer manipulators N87-10850
Effects of very high turbulence on convective heat transfer N87-11222
TURBULENT DIFFUSION
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430
TURBULENT FLOW
Direct numerical simulation of homogeneous strained turbulence N87-11120
The dynamics of heat transfer in turbulent pipe flow, part 3
[OEFZS-4351] N87-11133
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow
[NASA-TM-85948] N87-11143
Mass and momentum turbulent transport experiments N87-11201
Turbulence theory from a present-day point of view N87-11415
TURBULENT HEAT TRANSFER
The dynamics of heat transfer in turbulent pipe flow, part 3
[OEFZS-4351] N87-11133
TURBULENT JETS
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992
Mass and momentum turbulent transport experiments N87-11201
TWO DIMENSIONAL BODIES
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844
TWO DIMENSIONAL FLOW
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes
[DFVLR-FB-86-10] N87-11136
TWO DIMENSIONAL JETS
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
TWO PHASE FLOW
The scaling of two phase flow
[MEAH-64] N87-11139
TYPHOONS
Tropical cyclone report, 1985
[AD-A168284] N87-11464

U

U.S.S.R.
USSR Space Life Sciences Digest, issue 8
[NASA-CR-3922(09)] N87-11478
ULTRAHIGH FREQUENCIES
A prototype DSN X/S-band feed: Model 3 development N87-11027
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Land Mobile Radio/UHF Television Technical Advisory Committee final report in the matter of further sharing of the UHF television band by private land mobile radio services
[PB86-206562] N87-11070

ULTRASONIC FLAW DETECTION
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972

ULTRAVIOLET ASTRONOMY
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight
[BMFT-FB-W-85-025] N87-11655

ULTRAVIOLET RADIATION
Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 — satellite design
[CERT-4193-VOL-1] N87-10949
Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results — satellite coating
[CERT-4193-VOL-2] N87-10950
Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions — satellite coatings
[CERT-4193-VOL-3] N87-10951
Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements — satellite coatings
[CERT-4193-VOL-4] N87-10952
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651

ULTRAVIOLET SPECTROMETERS
Constructing a coherent long-term global total ozone climatology from the BUV, MFR, and SBUV/TOMS data sets
[DE86-009722] N87-11470

ULTRAVIOLET SPECTROSCOPY
Concave diffraction gratings
[NPL-MOM-77] N87-11592

UNIVERSITIES
Graduate engineering research participation in aeronautics
[NASA-CR-179796] N87-10828

UNSTEADY FLOW
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128

UPLINKING
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025

USER MANUALS (COMPUTER PROGRAMS)
MEPRO: A volume of IMIS procedures for the use of the operational-meteorological practice
[REPT-84-2] N87-11474
Introduction to the Tools for User-Friendly Business Applications (TUBA) system
[INF-85-24] N87-11526
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534

USER REQUIREMENTS
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2
[ESA-CR(P)-2219] N87-10880
Energy storage systems comparison for the space station N87-11075
Galileo Li/SO sub 2 battery modules program update N87-11076
Documentation of materials data for computer storage and retrieval
[DE86-009509] N87-11493
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676

UTAH
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009898] N87-11360

V

VACUUM
Vacuum polarization on black hole spacetimes N87-11668

VACUUM APPARATUS
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018

VALLEYS
Canalization of the atmospheric flow through valleys N87-11446

VANADIUM ALLOYS
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998

VANES
The 3-D inelastic analysis methods for hot section components (base program) N87-11208
Constitutive modeling for isotropic materials N87-11212

VAPOR DEPOSITION
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192

VARACTOR DIODES
Varactor tuned X-band FET oscillator
[BAE-BT-14500] N87-11114

VARIABILITY
Small scale and short term variability of global radiation in the Federal Republic of Germany N87-11440
The variability of sea surface temperatures N87-11460
A methodology for designing robust multivariable nonlinear control systems
[NASA-CR-179691] N87-11567

VARIABLE STARS
High resolution spectroscopy of RS CVn stars N87-11657

VARIABLE SWEEP WINGS
Flight-determined aerodynamic derivatives of the AD-1 oblique-wing research airplane
[NASA-TP-2222] N87-10871

VECTORS (MATHEMATICS)
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128

VEGETATION
Remote sensing methods to determine the vitality of vegetation
[LITERATUUROVERZICHT-42] N87-11235
Backscatter measurements from simulated vegetation structures N87-11254
The physical and physiological interpretation of vegetation spectral signatures N87-11272
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
Characterising vegetated surfaces with airborne MSS data — Multispectral Scanner (MSS) N87-11315

VEGETATION GROWTH
Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11265
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375

VEGETATIVE INDEX
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335

VELOCITY DISTRIBUTION
Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991

VELOCITY MEASUREMENT
Determination of the mass concentration of the particles in aerosols using the sound velocity measurement
[FR-235/20-1] N87-11574

VENTILATION
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168076] N87-11482

VERTICAL DISTRIBUTION
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435

VERY HIGH FREQUENCIES
Propagation of signals in the frequency band between 30 MHz and 100 MHz
[AD-A169332] N87-11063

VERY LARGE SCALE INTEGRATION
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043

VIBRATION DAMPING
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172484] N87-10859
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860
Passive damping concepts for slender columns in space structures
[NASA-CR-179807] N87-11178
Extension of the Ritz method to the forced, damped vibrations of rotating structural elements N87-11234

VIBRATION EFFECTS
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures — vibration effects N87-10887
Feasibility study of a launcher vibration environment simulator N87-10918
Spacecraft structural acoustics: Progress in vibration level prediction N87-10943
Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485

VIBRATION TESTS
Structural system identification using single and multiaxial vibration test data — spacecraft structures N87-10911
Experience on the Olympus modal survey test N87-10919

VIBRATORY LOADS
Effect of angular inflow on the vibratory response of a counter-rotating propeller
[NASA-CR-174819] N87-10840

VIEWING
Hot section viewing system
[NASA-CR-174773] N87-11144

VINEYARDS
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322

VISCOELASTIC DAMPING
Damping representation related to spacecraft structural design N87-10898

VISCOPLASTICITY
On the numerical integration of viscoplastic models — high temperature materials
[KFK-4082] N87-11135

VISCOUS FLOW
The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
Gas flow environmental and heat transfer nonrotating 3D program N87-11223

VISCOUS FLUIDS
Electro-rheological fluids. A brief description and typical applications
[BAE-BT-13744] N87-11132

VISIBILITY
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435
The influence of weather-active fronts on visual flight conditions N87-11437
News about the visibility of signal lights under the influence of the atmosphere N87-11454

VISIBLE INFRARED SPIN SCAN RADIOMETER
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels — Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR/VAS) N87-11295

VISIBLE SPECTRUM
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring — SPOT satellite N87-11310
Relation between soil moisture tension and spectral reflectance of different soil in visible and near-infrared range N87-11314
Spectral signature of snow in visible and near-infrared wavelengths N87-11316

VISUAL FLIGHT
The influence of weather-active fronts on visual flight conditions N87-11437

VISUAL OBSERVATION
THe effects of terrain clutter on observer behaviour during search of complex scenery
[BAE-BT-13535] N87-11484

VISUAL PERCEPTION
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435

Research in the area of visual search
[AD-A168923] N87-11483
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12489-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12489-VOL-2] N87-11491

VISUAL SIGNALS
Research in the area of visual search
[AD-A168923] N87-11483

VISUAL STIMULI
News about the visibility of signal lights under the influence of the atmosphere N87-11454

VISUAL TASKS
Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485

VOICE DATA PROCESSING
Experiments on the annotation of large quantities of speech using the ZIP dynamic time-warping algorithm
[RSRE-MEMO-3919] N87-11023

VOLCANOES
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338
Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983
[NASA-RP-1172] N87-11358
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009696] N87-11360
The influence of volcanics on the ground level air temperature (1781-1984) N87-11371
Data bases for isolating the effects of the increasing carbon dioxide concentration
[DE86-009709] N87-11469

VOLCANOLOGY
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009696] N87-11360
The influence of volcanics on the ground level air temperature (1781-1984) N87-11371

VORTEX GENERATORS
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453

VORTEX SHEDDING
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844

VORTICES
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453

VOYAGER 2 SPACECRAFT
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039
VLA feedhorn for Voyager encounter of Neptune N87-11047

W

WAFERS
Silicon wafer cleaning for integrated circuit fabrication
[RSRE-MEMO-3907] N87-11071

WAKES
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes
[DFVLR-FB-86-10] N87-11136

WARHEADS
The strategic defense initiative
[AD-A166147] N87-11644

WARNING SYSTEMS
Tropical cyclone report, 1985
[AD-A168284] N87-11464

WATER
Heat exchangeable liquid injected compressors
[ETN-86-97852] N87-11166
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179881] N87-11671

WATER DEPTH
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476

WATER VAPOR
Variations of the water vapor content in the lower troposphere between 20 deg N and 20 deg S during the last 20 years N87-11368

WATER WAVES
An experimental campaign for the determination of radar structure of the ocean at C band N87-11239

WATERSHEDS
Spatial analysis of storm depths from an Arizona raingage network
[NASA-CR-177186] N87-11483

WAVE DISPERSION
Some considerations of wave propagation
[KNMI-WR-86-2(GO)] N87-11069

WAVE EQUATIONS
Some considerations of wave propagation
[KNMI-WR-86-2(GO)] N87-11069

WAVE FRONTS
Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597

WAVE FUNCTIONS
Multifractal wave function at the localization threshold
[PREPRINT-499] N87-11547
Some aspects of wave-functions in disordered and incommensurate models
[DE85-703226] N87-11610

WAVE PACKETS
Some aspects of wave-functions in disordered and incommensurate models
[DE85-703226] N87-11610

WAVE PROPAGATION
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972
Propagation of signals in the frequency band between 30 MHz and 100 MHz
[AD-A169332] N87-11063
Some considerations of wave propagation
[KNMI-WR-86-2(GO)] N87-11069

WAVEGUIDE ANTENNAS
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
Printed circuit transmission line transitions
[AD-A169291] N87-11110

WAVELENGTHS
Stability of multilayers for short-wavelength optics
[DE86-012129] N87-11598

WEAK INTERACTIONS (FIELD THEORY)
Electroweak interactions
[PREPRINT-482] N87-11586

WEATHER
The influence of weather-active fronts on visual flight conditions N87-11437
Minor scale weather-watch and microbarograph project experiments 8620, 9415, 9416
[DE86-009641] N87-11466

WEATHER FORECASTING
The use of microcomputers for glider weather forecasting N87-11448
Tropical cyclone report, 1985
[AD-A168284] N87-11464
MEPRO: A volume of IMIS procedures for the use of the operational-meteorological practice
[REPT-84-2] N87-11474
The IMIS program NESO
[REPT-84-1] N87-11521

WEATHER STATIONS
A simple guidance forecast for 100 stations in Europe as a support for the weather report for holiday countries
[REPT-84-4] N87-11475

WEATHERING
Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327

WEIGHT (MASS)
National Transportation Safety Board safety recommendation N87-10852

WEIGHT REDUCTION
Development of a lightened structure for the GSR3 solar generator N87-10927
Material selection for carbon fiber reinforced composite structures — conferences
[ESA-TT-950] N87-10965

WEIGHTING FUNCTIONS
Cramer-Rao bounds for signal-to-noise ratio and combiner weight estimation N87-11038

WEST GERMANY
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment
[ISBN-3-88148-226-1] N87-11367
Small scale and short term variability of global radiation in the Federal Republic of Germany N87-11440
Climatological data of the Federal Republic of Germany N87-11443
Increase of the dust mass content in the air of Hamburg (West Germany) N87-11450
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461

WETLANDS
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-008904] N87-11337

WHEAT
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278
Calibrated microwave signature measurements of soil and wheat N87-11299

WHISKER COMPOSITES
Whisker-reinforced ceramic composites
[DE86-011058] N87-10980
Strain contrast in SiC whisker reinforced Al sub 2 O sub 3
[DE86-009537] N87-10981

WHITE NOISE
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Gaussian noise channel N87-11034

WIND (METEOROLOGY)
Minor scale weather-watch and microbarograph project experiments 8620, 9415, 9416
[DE86-009641] N87-11466

WIND EFFECTS
Conclusions from the migration of Barchans on the dominating wind conditions in desert regions N87-11413
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426
Satellite observations of atmospherically determined changes of the ocean surface temperature — hurricanes N87-11427

WIND MEASUREMENT
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements — sea surface winds N87-11241
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Sea wind fluctuations analysis N87-11249
Analysis of the ESA wind scatterometer campaign data N87-11251
The C and Ku band scatterometer results from Canadian participation in the ESA PROMESS ocean measurement campaign N87-11252
Atmospheric processes at the boundary of the Antarctic continent N87-11395

WIND SHEAR
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461

WIND TUNNEL APPARATUS
Details of low speed intake test facility at the Warton 2.7m x 2.1m wind tunnel
[BAE-AXM127] N87-10873

WIND TUNNEL MODELS
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431

WIND TUNNEL TESTS
An experimental investigation of dynamic ground effect N87-10833
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine
[IW-R511] N87-10845
Changes in the turbulent boundary layer structure associated with net drag reduction by outer layer manipulators N87-10850
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861
Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90
[NASA-TP-2350] N87-10870
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
Prop-fan slipstream effects using static simulators: Low speed task, phase 1
[BAE-B59R/R-D/610/13498] N87-10875
The high speed cascade wind tunnel: Still an important test facility for investigations on turbomachinery blades
[DFVLR-MITT-86-11] N87-10876
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
Wind tunnel investigation of the characterization of radar backscattering by different wave fields — sea waves N87-11261
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431
Dispersion of accidentally released heavy gases — wind tunnel tests N87-11432

WIND TUNNEL WALLS
Practical evaluation of wall pressure signature correction methods in the 2.7m x 2.1m low speed wind tunnel
[BAE-ARG-204] N87-10874

WIND TUNNELS
Aeronautical facilities assessment
[NASA-RP-1146] N87-10876

WIND TURBINES
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine
[IW-R511] N87-10845
WEST-3 wind turbine simulator development. Volume 1: Summary
[NASA-CR-174981] N87-11348
WIND VARIATIONS
Illustration of wind field time and space statistics during the TOSCANE-T campaign — scatterometry N87-11248
Sea wind fluctuations analysis N87-11249
WIND VELOCITY MEASUREMENT
Illustration of wind field time and space statistics during the TOSCANE-T campaign — scatterometry N87-11248
Local optimal determination of the wind field on sea from wind and pressure observations using an inverse method N87-11444
WINDMILLS (WINDPOWERED MACHINES)
La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August
[ESA-TT-960] N87-11019
Implementation of windmills in Gujarat, India
[ETN-86-97720] N87-11342
WING OSCILLATIONS
Unsteady airload computations for airfoils oscillating in attached and separated compressible flow
[NLR-MP-85040-U] N87-10846
WING PLANFORMS
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
WING ROOTS
Critical composite joint subcomponents: Analysis and test results
[NASA-CR-3711] N87-10975
WING TIP VORTICES
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129
WING-FUSELAGE STORES
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860
WINGS
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129
WROUGHT ALLOYS
Identification of creep mechanisms and quantitative description of stress regimes relevant to design — high temperature plants; wrought alloys
[OEFZS-4352] N87-11232

X

X RAY ANALYSIS
A survey of recent developments in X-ray diffractometry
[MQAD-TR-910] N87-10963
Electron transport in integral photoemission X-ray standing wave analysis
[USIP-86-03] N87-11614
X RAY ASTRONOMY
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
X-ray bursts from GX 17+2: A new approach
[MPE-PREPRINT-48] N87-11678
X RAY DIFFRACTION
Measurement of stress distributions in adhesive bonded joints
[AD-A169176] N87-11227
Polynomial grating
[AD-D012313] N87-11594
Stability of multilayers for short-wavelength optics
[DE86-012129] N87-11598
X RAY SOURCES
X-ray bursts from GX 17+2: A new approach
[MPE-PREPRINT-48] N87-11678
Disappearance of periodic X-ray minima in AM Her
[MPE-PREPRINT-52] N87-11680
X RAY SPECTRA
Search for orbital X-ray variation in Sco X-1
[MPE-PREPRINT-51] N87-11679
X RAY STARS
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
X RAY STRESS MEASUREMENT
Measurement of stress distributions in adhesive bonded joints
[AD-A169176] N87-11227
X RAY TELESCOPES
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system — X ray optics N87-10931
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE-PREPRINT-33] N87-11648
X RAYS
Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea
[PB86-213873] N87-11364
X-29 AIRCRAFT
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861

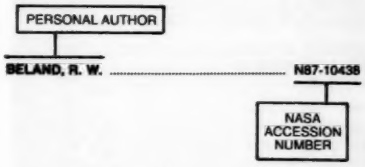
Y

YANG-MILLS FIELDS
Superstrings and geometry of superspace
[DE86-012044] N87-11622
YIELD POINT
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231

Z

ZIRCONIUM OXIDES
Whisker-reinforced ceramic composites
[DE86-011058] N87-10980
ZODIACAL LIGHT
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight
[BMFT-FB-W-85-025] N87-11655

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AARTS, J. M. N87-11554
ABDELLAOUI, A. N87-11266
ABRAMS, M. J. N87-11274
ACKLEY, S. F. N87-11476
ADAIR, R. T. N87-11150
ADAMS, A. T. N87-11059
ADAMS, J. C., JR. N87-10835
ADAMS, L. J. N87-11438
ADRIAN, G. N87-11408
AGRAIN, M. N87-10937
AGUIRRE, S. N87-11035
N87-11036
AHERN, F. J. N87-11330
AKE, R. L. N87-11353
ALBUGUES, F. N87-10940
ALEM, E. M. N87-11323
ALEXANDER, H. N87-11159
ALI, A. W. N87-11606
ALLARD, J. P. N87-10929
ALMAND, B. J. N87-11534
N87-11535
N87-11536
ALTARELLI, G. N87-11585
AMTMANN, R. N87-11429
ANDERS, G. N87-10872
ANDERSON, O. L. N87-11224
ANDERSON, T. O. N87-11039
ANDERSON, W. L. N87-11190
ANDERSSON, T. N87-10924
ANDREOLI, G. N87-11301
ANG, V. N87-11061
ANGELINI, P. N87-10981
APERS, P. M. G. N87-11634
APPLEWHITE, A. Z. N87-11101
ARBOCZ, J. N87-10889
ARTHEY, R. P. N87-11615
N87-11616
ARYA, V. K. N87-11135
ASH, R. L. N87-11126
ASHCROFT, N. W. N87-11620
ASVELD, P. R. J. N87-11522
N87-11570
ATKINSON, P. F. N87-11142
ATKINSON, W. H. N87-11186
ATTEMA, E. N87-11239
N87-11240
AUCH, W. N87-11148
AUCLAIR, J. M. N87-10938
AURIEMMA, G. N87-11682

B

BABOVSKY, H. N87-11137
BACH, W. N87-11397
N87-11403
BACILIERI, P. N87-11495
BADCOCK, C. C. N87-11102
BAIER, H. N87-10891
BAILEY, M. C. N87-11105
BAILEY, R. N87-11168
BAK, P. N87-11613
BALIUNAS, S. L. N87-11651
BANHEGYI, G. N87-10978
BANHOLZER, W. F. N87-10960
BANNINGER, C. N87-11309
BARBAY, G. N87-10946
BARDILL, M. N87-11518
BARET, F. N87-11278
N87-11310
BARHEN, J. N87-11538
BARKER, R. E., JR. N87-11619
BARKMANN, W. N87-11424
BARNES, J. A. N87-11077
N87-11078
BARNETT, T. P. N87-11468
BARREAU, R. N87-10872
BARRETT, C. S. N87-11227
BARTEL, C. N87-11501
BATHKER, D. A. N87-11027
N87-11047
BAUER, O. H. N87-11355
N87-11604
BECHER, P. F. N87-10980
BECKER, F. N87-11253
N87-11279
BECKER, P. N87-11393
BECKMANN, A. N87-11439
BEGUE, A. N87-11310
BEHENG, K. D. N87-11392
BEHR, H. N87-11441
BEHR, H. D. N87-11440
BEHRENDT, J. N87-11443
BELITZ, H. J. N87-11395
N87-11442
BELK, D. M. N87-11128
BELSCHER, T. N87-11282
BELTZ, M. W. N87-11008
BELYTSCHKO, T. N87-11511
BENESCH, B. N87-11443
BERARDI, E. N87-11682
BERGLIND, T. N87-11545
BERGMANN, H. W. N87-10935
BERGQUIST, A. N87-11118
BERNDT, C. C. N87-11196
BERNER, H. N87-10857
BERRIER, B. L. N87-10838
N87-10839
BERTRAM, A. N87-10902
N87-10919
BESNIER, F. N87-10899
BEVIS, F. N87-11327
BEY, I. N87-11500
BIDAULT, M. N87-10991
BIERCAMP, J. N87-11399
BIGGAR, S. F. N87-11282
BIGGERS, D. N87-11517
BIRD, A. C. N87-11311
BIRRONG, W. N87-11375
BIS, R. F. N87-11078
BIS, R., F. N87-11077
BISBOLLI, P. N87-11371
BITTANTI, S. N87-11519
BJOERKMAN, U. N87-11602
BLAIR, M. F. N87-11221
BLAKE, G. A. N87-11665
BLANC, J. P. C. N87-11540
BLANCHARD, A. N87-10834
BLANCHARD, A. J. N87-11254
N87-11260
BLANCHET, C. N87-11247
BLANK, S. J. N87-11029
BLANKENBERG, F. N87-11342
BLOCK, J. N87-10989
BLOM, A. F. N87-11231
BLOYET, E. N87-11609
BODAGALA, P. R. N87-10900
BODECHTEL, J. N87-11296
BOENDER, C. G. E. N87-11553
BOERCHERS, G. N87-10881
BOFFO, M. N87-11501
BOHLEN, R. N87-10881
BOIDON, M. N87-11655
BOISSARD, P. N87-11273
BOISSE-LAPORTE, C. N87-11609
BOKHARI, S. N87-11509
BOLZERN, P. N87-11519
BOND, H. E. N87-11653
BONDESON, D. W. N87-11092
BONTSEMA, J. N87-10957
N87-11559
BOOKER, M. K. N87-11493
BOONE, S. N87-11670
BORDER, J. S. N87-11055
BORELLO, G. N87-10908
BORST, W. N87-11115
BORSTAD, G. A. N87-11275
BOTHOREL, A. N87-11312
BOUCHER, P. N87-11323
BOURCIER, R. J. N87-10999
BOUWMANS, J. M. M. N87-11339
BOWEN, H. K. N87-11009
BOWERS, A. H. N87-10861
BRADLEY, R. S. N87-11489
BRANDT, K. N87-11082
BRAZZINI, G. N87-10941
BREEMAN, J. H. N87-10863
BREIL, J. F. N87-10834
BRETT, L. N87-10953
BREWE, D. E. N87-11124
BRICCARELLO, M. N87-11016
BRIEL, U. G. N87-11649
BRISTEAU, M. O. N87-11122
BRITTON, D. L. N87-11095
BROAD, K. S. N87-10994
BROADWELL, J. E. N87-10992
BROGLIO, C. N87-11507
BROMSVOORT, W. F. N87-11529
BROUSTET, Y. N87-10941
BROUWER, G. W. N87-11475
BROWN, D. H. N87-11035
BROWN, K. T. N87-10909
BROWN, L. D. N87-11357
BROWN, P. C. N87-10840
BROWN, P. W. N87-10843
BRUEGGE, C. J. N87-11292
BRUENING, R. N87-11504
BRUST, G. N87-10857
BUCHHOLZ, F. G. N87-10933
BUCK, O. N87-11228
BUHL, H. N87-11003
BUNIN, B. L. N87-10973
N87-10975
BUNTE, S. W. N87-10988
BUNZ, H. N87-11581
BUONCRISTIANI, A. M. N87-10972
BURGESS, O. N87-11600
BURKE, W. R. N87-10886
BURLEY, J. R., II N87-10838
BURNS, M. S. N87-11660
BURNS, S. W. N87-10978
BURNS, W. K. N87-11152
BURRAGE, K. N87-11582
BURT, R. W. N87-11051
BURTON, R. A. N87-11108
BURTON, R. G. N87-11106
BUSEN, R. N87-11391

C

CABIBBO, N. N87-11495
CAESAR, B. N87-10913
CAHILL, P. N87-10985
CAHOUET, J. N87-11121
CAILLAULT, J. P. N87-11656
CAIRNS, E. J. N87-11112
CALLIES, U. N87-11420
CAMPBELL, R. H. N87-11510
CANEILLES, J. L. N87-10887
CANTWELL, H. F. N87-10867
CAPONE, F. J. N87-10870
CAPRON, B. A. N87-11292
CARIUS, D. N87-11428
CARLSON, H. W. N87-10829
CARNEY, B. W. N87-11653

CARR, D. B. N87-11626
CARROLL, J. A. N87-10944
CASELLES, V. N87-11324
N87-11334
CASTELLANI, C. N87-11547
N87-11617
CASTLE, K. R. N87-11292
CATALDO, R. L. N87-11100
CATANI, J. P. N87-10953
CAVAYAS, F. N87-11269
CECCONI, J. L. N87-10934
CELLE, F. N87-10918
CERI, S. N87-11631
CERUTTI-MAORI, G. N87-11477
CERVELLE, B. N87-11312
N87-11323
CHA, A. G. N87-11049
CHAGINI, H. N87-11126
CHAMPAGNE, M. N87-11241
N87-11248
CHAMPION, I. N87-11278
CHAN, J. T. H. N87-10882
CHANG, C. K. N87-11589
CHANG, G. C. N87-11196
CHANG, I. C. N87-10841
CHANG, J. J. N87-11041
CHANG, R. C. N87-10833
CHANTRY, J. A. N87-10888
CHARRON, F. N87-10912
CHEMOUL, B. N87-10900
N87-10918
CHEN, D. Y. N87-11546
CHEN, H. H. N87-11537
CHEN, M. F. N87-11263
CHEN, P. C. N87-11206
CHERNEY, R. O. N87-11145
CHIAN, C. T. N87-11028
CHIAPPETTA, S. N87-11011
CHIEN, J. C. N87-10978
N87-10979
CHIN, B. A. N87-10998
CHIU, Y. T. N87-11681
CHLOND, A. N87-11417
CHO, M. L. N87-11170
CHO, Y. I. N87-11080
CHOROWICZ, J. N87-11312
N87-11323
CHOU, C. K. N87-11479
CHRIST, K. A. N87-11487
CHURCH, H. W. N87-11466
CICCOTTI, G. N87-11587
CIERNIEWSKI, J. N87-11314
CIESLA, J. J. N87-11079
CLAGETT, J. A. N87-11479
CLARKE, J. N87-11109
CLAUSEN, M. N87-11389
CLAYTON, J. D. N87-10859
N87-10860
CLEVER, W. C. N87-10842
CLEVERS, J. G. P. W. N87-11297
CLOUGH, A. J. N87-11520
COFFEY, H. E. N87-11364
N87-11365
COLOMBO, G. V. N87-11481
COMTAT, M. N87-11117
CONVERSI, M. N87-11583
COOK, J. N87-10983
COOPER, H. W. N87-11039
COOPER, L. P. N87-10959
CORETTI, C. N87-11664
COSTANTINI, F. N87-11495
COULTER, M. N87-11337
COWLEY, P. J. N87-11626
CRAIG, R. R. N87-10898
CRAWFORD, R. A. N87-11223
CROSS, J. F. N87-11022
CROW, R. B. N87-11054
CUBASCH, U. N87-11405
CUCCHISSI, J. J. N87-11028
CUMMINS, R. J. N87-10943
CURRAN, P. J. N87-11315
CURRIE, I. F. N87-11499
CURRY, R. E. N87-10871
CURTAIN, R. F. N87-11559
CYGAN, R. T. N87-11338
CYNN, H. C. N87-11670
CZEPLAK, G. N87-11390

D

DAAN, H. N87-11474
DAGOSTINI, G. N87-11582
DAHAUT, P. N87-11293
DAME, L. T. N87-11206
N87-11212
DAMPER, R. I. N87-11175
DANGTRONG, T. N87-10906
DANKERT, C. N87-10981
DANKO, J. C. N87-11161
DAUZAT, J. N87-11267
DAVIDSON, G. T. N87-11681
DAVIDSON, J. M. N87-11055
DAVIS, P. B. N87-11077
DAWSON, S. N87-11081
DAY, G. W. N87-11573
DEACON, G. E. N87-11169
DEAN, G. J. N87-11485
DEANE, J. R. N87-10832
DEBELLIS, W. B. N87-11487
DEBOER, G. A. N87-11566
DEBOLD, F. C. N87-11077
DEBOS, R. N87-11568
DEBUSSCHE, G. N87-11313
DEFOSSE, H. N87-10907
DEGIER, H. M. N87-11521
DEGISCHER, H. P. N87-11232
DEGRAAN, J. G. N87-11553
DEJONGE, H. W. G. N87-11530
DEKONING, A. U. N87-10893
DELIGIANNIS, E. N87-11080
N87-11081
DELOOR, G. P. N87-11251
DELORME, P. N87-11117
DEMARIA, M. N87-11584
DEMASI, J. N87-11199
DEPKOVICH, T. M. N87-11534
N87-11535
N87-11536
DEROO, C. N87-11293
DEROUVRAY, A. N87-10936
DESCHAMPS, P. Y. N87-11293
N87-11363
DESTUYNDER, R. N87-10872
DETERING, H. W. N87-11407
DETTLEFF, G. N87-10961
DEUBLEIN, G. N87-11015
DEUTSCH, L. J. N87-11043
DEVAUX, J. L. N87-10892
DEXTER, P. C. N87-10832
DHAR, A. N87-11622
DICASTRO, C. N87-11617
DICKINSON, J. T. N87-11155
DIEBEL-LANGHOR, D. N87-11284
DIEKMANN, F. N87-11462
DIETRICH, R. N87-11230
DIJKSHOORN, A. N87-11139
DIMOTAKIS, P. E. N87-10992
DING, X. N87-11308
N87-11333
DINGUIRARD, M. C. N87-11292
DINGUS, R. S. N87-11157
DIXON, T. H. N87-11055
DOBERITZ, R. N87-11406
DOHERR, K. F. N87-11525
DOHERTY, T. J. N87-11482
DOITTAU, P. O. N87-10881
DOLINAR, S. J. N87-11036
DOMS, G. N87-11392
DONALDSON, R. R. N87-11165
DONLEY, S. W. N87-11088
DOOLEN, G. N87-11537
DOWLATYARI, P. N87-10894
N87-10936
DOWNS, G. S. N87-11054
DOZIER, J. N87-11316
DRING, R. P. N87-11221
DRUILHET, A. N87-11242
N87-11244
N87-11250
DUBOIS, J. N87-10894
DUEBER, R. E. N87-11074
DULOUT, J. P. N87-10887
DUM, C. T. N87-11647
DUNEMAN, D. C. N87-11154
DUPREE, A. K. N87-11651
DUQUETTE, D. J. N87-10997
DURAND, P. N87-11242
N87-11244
N87-11250
DYSON, H. B. N87-11060
DZIADOS, J. N87-11482

E

EAGLESON, P. S. N87-11483
EATON, D. C. G. N87-10943
ECKHARDT, K. N87-10917
EDWARDS, B. J. N87-10865
EFRON, L. N87-11053
EGGER, R. A. N87-10960
EGGERS, H. N87-10932
EICHHORN, J. N87-11411
EINSTEIN, J. R. N87-11538
EKER, Z. N87-11657
ELLIS, J. N87-11052
ELLIS, J. R. N87-11210
ELLIS, J. S. N87-11470
ELMORE, D. L. N87-11185
ELROD, H. G. N87-11124
ELVIS, M. N87-11651
EMEIS, S. N87-11386
N87-11446
EMERY, B. J. N87-10885
EMORI, Y. N87-11287
N87-11328
ENGLER, E. E. N87-10923
ENGMANN, R. N87-11524
N87-11526
ENNENGA, U. N87-11444
EPIARD-MOREAU, L. N87-11312
EPPEL, D. N87-11382
N87-11409
N87-11452
ERCKMANN, V. N87-11068
ERKELENS, L. J. J. N87-10863
ESSEN, H. H. N87-11445
ESSER, G. N87-11385
ESSICK, R. B. N87-11510
ESSINK, L. J. B. N87-11635
ESTIENNE, J. P. N87-10953
ETLING, D. N87-11407
EULER, H. N87-10857
EVANS, V. M. N87-10964
EZRATY, R. N87-11241
N87-11248
N87-11249

F

FAGERLAND, E. N87-11326
FAGERLUND, E. N87-11300
FARBER, J. H. N87-10979
FARRIS, R. J. N87-10979
FASTAMPA, R. N87-11624
FECHT, B. A. N87-11489
FEDOSEJVES, G. N87-11330
FENNESSEY, N. M. N87-11483
FERRANTE, J. G. N87-10953
FERRARA, A. M. N87-11014
FERRARI, G. N87-11317
FERRARI, V. N87-11664
FERRO-LUZZI, M. N87-11583
FIEDLER, F. N87-11386
N87-11446
FIELD, J. N87-11582
FINDLAY, J. T. N87-10884
FINGER, J. E. N87-11384
FIORENTINI, G. N87-11495
FISCHER, D. N87-11549
FISCHER, G. N87-11400
FIX-STERN, J. N87-11501
FLEER, H. N87-11377
FLETCHER, C. D. N87-11590
FLOHN, H. N87-11368
FORD, D. A. N87-11616
FORD, G. E. N87-11336
FOREMAN, J. R. N87-11366
FORKEL, R. N87-11387
FORTAK, H. N87-11414
FOSTER, C. N87-11042
FOURRIER, T. N87-11003
FOX, C. J. N87-11645
FRAAS, A. P. N87-10947
FRAGAPANE, S. E., JR. N87-11597
FRANCIS, A. J. N87-11480
FRANCIS, R. W. N87-11085
FRANCIS, W. E. N87-11681
FRANCO, M. M. N87-11025
FRANK, H. N87-11078
FRANKLIN, A. L. N87-11489
FRANKLIN, J. N87-11237
FRANZ, J. N87-10939
FREZET, M. N87-10953
FRIEDRICH, R. N87-11504
FRITSCHE, E. N87-10925
FROLIK, Z. N87-11571
FROUIN, R. N87-11295
N87-11303
FRYXELL, R. E. N87-11193
FUCCI, A. N87-11495
FUCHS, W. N87-11434
FUKUHARA, M. N87-11328
FULLER, C. R. N87-11577
FUNG, A. K. N87-11254
N87-11263

G

GAEDKE, M. N87-10935
N87-10968
GAERTNER, V. N87-11455
GALEOTTI, S. N87-11495
GALLAY, G. N87-10938
GANDIA, S. N87-11334
GAO, L. Z. N87-11333
GARNIER, C. N87-10941
GARRARD, G. R. N87-11311
GARSHNEK, V. N87-11478
GATES, W. L. N87-11467
GAUTHIER, J. P. N87-10918
GAUTHIER, R. P. N87-11277
GAUTIER, C. N87-11295
N87-11303
GEAR, C. W. N87-11516
GEARY, J. M. N87-11154
GEB, M. N87-11437
GEDWILL, M. A. N87-11194
GEIER, B. N87-10895
GEMMILL, G. W. N87-11077
GEORGE, A. H. N87-11113
GERLACH, T. M. N87-11338
GEYSELAERS, H. N87-10928
GHAN, S. J. N87-11465
GHEZZI, C. N87-11519
GILDER, P. J. N87-11168
GILLIAM, F. N87-11129
GIRARD, A. N87-10897
GIRARD, F. N87-10938
GIURA, M. N87-11624
GLASER, H. N87-10910
GLICKSMAN, L. R. N87-11011
GLOECKLER, G. N87-11356
GLOWIENKA-HENSE, R. N87-11368
N87-11374
GODDIJN, I. A. M. N87-11556
GOEKOGLU, S. A. N87-11192
GOEL, N. S. N87-11265
GOETTING, H. C. N87-10935
GOETZ, A. F. H. N87-11274
GOLDBERG, J. N87-11507
GOMEZ, M. F. N87-10940
GONZALEZSANABRIA, O. D. N87-11073
N87-11095
GOSLINE, R. M. N87-11054
GOTTLOB, G. N87-11631
GOULETTE, M. J. N87-11615
GOWER, J. F. R. N87-11275
GRAHAM, R. A. N87-11611
GRANGER, J. P. N87-10953
GRANIER, A. N87-11609
GRANT, H. N87-11188
GRANT, H. P. N87-11190
GRASS, J. N87-11510
GRASSI, P. N87-11301
GRASSI, H. N87-11396
GRATZKI, A. N87-11462
GRAY, A. L. N87-11252
GRAY, L. N87-11247
GRAZIANI, F. N87-10901
GREEN, R. N87-11157
GREEN, R. S. N87-11099
GREENBERG, H. S. N87-10923
GREENE, W. H. N87-11177
GREENGARD, L. N87-11515
GREGOIRE, J. M. N87-11317
GREGORY, D. A. N87-11595
GREIF, H. D. N87-10962
GREIF, R. N87-10988
GREMBAN, K. D. N87-11534
N87-11535
N87-11536
GREULICH, H. N87-10970
GRIER, T. N87-11265
GRIMES, R. N. N87-10987
GRIMM, M. J. N87-11050
GRINDHAMMER, G. N87-11582
GRISWOLD, T. W. N87-11045
GROOTHUIZEN, R. J. P. N87-11172
GROSS, G. N87-11413
N87-11447
GROSSMANN, S. N87-11415
GROVES-KIRBY, C. J. N87-10958
GRUNBERG, D. B. N87-11567
GUISSARD, A. N87-11258
GULINO, D. A. N87-10960
GULKIS, S. N87-11054
GUNDERSEN, M. N87-11062
GUPTA, B. K. N87-11193
GURSKY, H. N87-11594
GUY, A. W. N87-11479
GUYENNE, T. D. N87-11238
GUYOT, G. N87-11278
N87-11310

H

HAAG, R. N87-11091
HAAG, R. L. N87-11085
N87-11102
HAENEL, G. N87-11391
HAENEL, H. D. N87-11430
HAERENDEL, G. N87-11355
N87-11603
HAGEDORN, N. H. N87-11073
HAGELIN, S. N87-11118
HAGGERTY, J. S. N87-11009
HAIDT, D. N87-11582
HALBERT, E. C. N87-11538
HALEY, D. C. N87-11534
N87-11535
N87-11536
HALFORD, G. R. N87-11183
HALL, S. N87-11091
HALLER, R. L. N87-10859
N87-10860
HALLIKAINEN, M. T. N87-11288
HALPERT, G. N87-11078
N87-11080
N87-11081
HAMAKER, H. C. N87-11351
HAMILTON, D. A. N87-10886
HAMMOND, E. C., JR. N87-11142
HANCOCK, J. P. N87-10866
HANSON, D. W. N87-11597
HANTEL, M. N87-11372
N87-11381
HARDEMAN, R. W. N87-11071
HARISMENDY, J. M. N87-11117
HARRINGTON, R. F. N87-11105
HARRIS, F. W. N87-11008
HART-SMITH, L. J. N87-10973
HARTMANN, J. N87-11461
HARTT, R. W. N87-11630
HARWIT, M. N87-11652
HASINGER, G. N87-11662
HASSE, L. N87-11373
N87-11444
HASSLER, J. M., JR. N87-10859
HAUF, T. N87-11410
HAUG, E. N87-10894
N87-10936
HAUGUEL, A. N87-11121
HAWKINS, R. K. N87-11252
HEARN, C. P. N87-11105
HEARN, D. R. N87-11680
HECK, M. L. N87-10884
HEIDARY, K. N87-11059
HEIDE, W. N87-10881
HEIMANN, D. N87-11448
HEISE, E. N87-11401
HELIN, H. N87-11129
HEMKER, P. W. N87-11140
HEMMATI, H. N87-11031
HENAULT, C. N87-10991
HENDRY, D. F. N87-11045
HENGSTERMANN, T. N87-11284
HENKEL, J. N87-11298
HENN, J. W. N87-11167
HENSE, A. N87-11368
N87-11422
HERAKOVICH, C. T. N87-10976
N87-10977
HERBERT, F. N87-11419
N87-11451
HERGENROTHER, P. M. N87-11006
HERMAN, M. N87-11293
N87-11363
HERRMANN, W. N87-11229
HERZOG, J. N87-10881
HESSLER, G. N87-11449
HIGGINS, M. A. N87-11114
HILBERT, C. N87-11109
HILBRANDT, E. N87-10896
HILLERY, R. V. N87-11196
HIROSAWA, H. N87-11318
HIRT, G. N87-11170
HITT, E. N87-11507
HLAVA, P. F. N87-11338
HOBART, H. F. N87-11189
HODGE, A. M. N87-11071
HODGSON, M. E. N87-11337
HOEKMAN, D. H. N87-11259
HOEKSEMA, J. T. N87-11677
HOELLER, H. N87-11410
HOFFERT, M. I. N87-11673
HOFFMAN, J. J. N87-10848
HOFFMANN, H. E. N87-11433
HOHEISEL, H. N87-10878
HOLLAND, R. N87-11149
HOLLINGER, A. B. N87-11275
HOLLOWAY, C. M. N87-11506
HOLM, I. N87-11341
HOLM, R. G. N87-11292
HOLMAN, L. K. B. N87-11484
HOLMES, H. K. N87-11343
HOLT, S. N87-11679
HOLZDEPPE, D. N87-10910
HOOGENBOOM, S. N87-11173
HOOKE, L. R. N87-11478
HORIE, Y. N87-11611
HORNBERGER, K. N87-11135
HOSGOOD, B. N87-11301
HOUWINK, R. N87-10846
HOVESTADT, D. N87-11356
HOWLAND, C. N87-11001
HSI, W. H. N87-11228
HSU, I. S. N87-11040
N87-11041
HU, H. N87-11589
HUANG, T. S. N87-11686
HUANG, W. M. N87-10986
HUBAUX, A. N87-11317
HUCHRA, J. P. N87-11651
HUCK, K. D. N87-11111
HUDSON, T. D. N87-11595
HUENERS, H. N87-10914
HUEPPI, R. N87-11299
HUETE, A. R. N87-11258
HUETTMANN, H. J. N87-10925
HUGGINS, R. A. N87-11015
HUGHES, P. J. N87-11141
HULSE, C. N87-11188
HULTBERG, R. N87-10838
HUMMEL, D. N87-10939
HUNDSDORFER, W. H. N87-11551
N87-11560
N87-11562
HUNT, J. B. N87-11580
HURD, W. J. N87-11033
N87-11035
N87-11036
N87-11039
HUSBANDS, C. R. N87-11108
HUSSAINI, M. Y. N87-11125
N87-11127
HUTLEY, M. C. N87-11592
HWANG, W. C. N87-11088

I

IBRAHIM, S. R. N87-10915
IHSE, M. N87-11319
ILES, A. R. N87-11311
IMBERT, J. F. N87-10897
IMBERT, N. N87-10864
IMBRIALE, W. A. N87-11029
IPAVICH, F. M. N87-11356
ISEMER, H. J. N87-11373
ISHIDA, H. N87-11318
IVENS, R. N87-11474
N87-1[illegible]75
IVENS, R. A. A. M. N87-[illegible]521

J

JACK, C. D. N87-11518
JACOB, K. N87-11017
JACOBS, J. N87-11482
JACOBSON, K. J. N87-11492
JAFRI, J. N87-11353
JAGIELSKI, J. M. N87-11089
JAHNE, B. N87-11281
JANSEN, P. G. N87-11496
N87-11533
JANUS, J. M. N87-11128
JANZEN, G. N87-11057
JASCOLLA, F. N87-11329
JENSEN, B. P. N87-11668
JENSEN, J. R. N87-11337
JEWELL, J. L. N87-11593
JHA, V. L. N87-10912
JOBARD, I. N87-11307
JOHNSON, B. V. N87-11201
JOHNSON, D. L. N87-11030
JOHNSON, G. M. N87-11140
JOHNSON, J. M. N87-11343
JOHNSON, M. L. N87-11671
JOHNSTON, G. N87-11510
JONES, F. B. N87-11107
JONES, J. D. N87-11577

JONES, P. D. N87-11469
JORDAN, E. H. N87-11217
JUDD, M. D. N87-10940
JUNG, H. J. N87-11403

K

KADRO, A. N87-11320
KALKER, J. J. N87-11171
KALLENBERG, W. C. M. N87-11566
KALSON, S. N87-11034
KAMINAR, N. R. N87-11351
KAMINSKI, U. N87-11450
KAPITANOV, V. Y. N87-11355
N87-11605
KAPITZA, H. N87-11409
KAPLAN, P. D. N87-11058
KARASOEZEN, B. N87-11552
KARASZ, F. E. N87-10978
KASPAREK, W. N87-11068
KATOW, M. S. N87-11026
KAUFMAN, A. N87-11344
N87-11346
N87-11347
KAUFMANN, H. N87-11298
KAYNAK, U. N87-10849
KEARNS, J. A. N87-11575
KEEFE, J. N87-10916
KEEFER, K. D. N87-11012
KEISER, J. R. N87-11000
KELLEY, J. H. N87-11536
KELLNER, G. N87-11394
KELLY, G. M. N87-10884
KELLY, J. H. N87-11534
N87-11535
KENNY, K. N87-11510
KENYON, S. N87-11651
KHELFA, A. N87-11313
KHOA, D. N87-11120
KIM, K. S. N87-11214
KIMES, D. S. N87-11264
KIMURA, A. N87-11287
KING, T. R. N87-11157
KIRSCHKE, L. N87-10932
KJELLGREN, J. N87-11341
KLAASSENS, J. B. N87-11116
KLECKER, B. N87-11356
KLEIN, M. J. N87-11054
KLEMAN, J. N87-11321
N87-11326
KLUG, J. N87-10931
KNEILE, K. R. N87-10835
KNIGHT, N. F., JR. N87-11177
KNORR, M. N87-10919
KNOTTENBERG, H. N87-11379
KNOX, C. E. N87-10864
KOEHLER, B. N87-11250
KOENIG, G. N87-11431
N87-11432
KOHOUT, L. L. N87-11073
KOK, M. N87-11557
N87-11628
KOPPENWALLNER, G. N87-10961
KOPPER, F. C. N87-11225
KOREN, B. N87-10847
KORNDOERFER, V. N87-11504
KOROBEINIKOV, V. G. N87-11355
KOTTMEIER, C. N87-11395
N87-11442
KOVALCHUK, M. V. N87-11614
KOWALCHIK, L. A. N87-11077
KOZAK, F. E. N87-11110
KRAFT, D. N87-10879
KRAMM, G. N87-11451
KRANBUEHL, D. E. N87-11007
KRAUZE, L. D. N87-11534
N87-11535
N87-11536
KRUMMERICH, M. B. N87-11146
KUIPER, M. N87-11633
KULIG, A. N87-11354
KUMAGAI, H. N87-10862
KUMRIC, H. N87-11068
KUNTZE, U. N87-11501
KURZ, L. L. N87-11479
KUSHIMA, H. N87-10993
KYONO, J. N87-10993

L

LABAUNE, G. N87-10953
LABONTE, M. N87-11291
LACAZE, B. N87-11313
LACKNER, J. L. N87-11097
LAFLEN, J. H. N87-11212
N87-11214
LAHODNY, H. N87-11232
LAHRAOUI, L. N87-11313
LANGBEIN, D. N87-10881
LANGE, H. J. N87-11416
LANGMEIER, A. N87-11678
LANKFORD, A. B. N87-11227
LANNELONGUE, N. N87-11290
LAPIERRE, H. N87-10912
LAUTENSCHLAGER, M. N87-11382
LAVANANT, L. N87-11249
LAVAZZA, L. N87-11631
LAWRENCE, R. W. N87-11105
LAWSON, D. D. N87-11078
LAY, G. N87-11501
LAZAR, S. N87-11080
LE-TOAN, T. N87-11257
LEAVITT, L. D. N87-10839
LECKIE, D. G. N87-11330
LEDWINA, T. N87-11566
LEE, C. P. N87-11352
LEE, H. Y. N87-11537
LEE, Y. C. N87-11537
LEFEBVRE, R. H. N87-11327
LEGG, C. A. N87-11311
LEGG, S., J. N87-11482
LEGGE, H. N87-10961
LEHMANN, F. N87-11285
LEISAWITZ, D. T. N87-11659
LEMCKE, C. N87-11475
LEMIEUX, G. H. N87-11291
LENT, H. M. N87-10844
LEONG, A. N87-11080
LEONHARDT, S. N87-11501
LEPETRE, Y. N87-11598
LEPRIEUR, C. N87-11270
LEPRINCE, P. N87-11609
LESHKEVICH, G. A. N87-11280
LEVI, D. N87-11546
LEVINE, S. R. N87-11182
LEVITT, K. N87-11507
LEVKOV, L. N87-11452
LEVY, L. N87-10953
LEVY, R. N87-11028
LEWIN, W. H. G. N87-11662
N87-11678
LI, Y. S. N87-11546
LICATA, R. N87-10903
LICHTEN, S. M. N87-11055
LIEFERMANN, A. N87-11261
LIEFTINCK-KOEIJERS, C. A. J. N87-11585
LIERKE, E. G. N87-10881
LILJEQUIST, D. N87-11614
LILLEY, D. G. N87-11203
LIN, H. T. N87-10998
LIN, S. N87-11512
LINDEMANN, C. N87-11437
LINDHOLM, U. S. N87-11211
LINGG, L. J. N87-11292
LINK, M. N87-10911
LIOU, M. S. N87-11543
LIU, H. W. N87-11215
LIVINGSTON, E. M. N87-11150
LO, Y. T. N87-11061
LOHMEYER, A. N87-11431
LOKSHIN, A. N87-11054
LONG, A. E. N87-11243
LONGSWORTH, R. C. N87-11164
LOOTSMA, F. A. N87-11553
LOPES, A. N87-11257
LOPEZ-GARCIA, M. J. N87-11324
LOPEZ, J. M. N87-11245
LOUBERSAC, L. N87-11262
LOUDIANA, M. A. N87-11155
LOUGHLIN, W. P. N87-11311
LOUIE, S. G. N87-10964
LUEDECKE, C. M. N87-11015
LUGINSLAND, J. N87-11170
LUKERT, D. N87-11260
LUNDBERG, B. G. N87-11486
N87-11637
LUNDEN, B. N87-11300
N87-11332
LUSIGNOLI, M. N87-11588
LUTHER, F. M. N87-11470
LUTZ, H. J. N87-11462
LYS, X. N87-10991

M

MA, C. H. N87-11333
MACCRACKEN, M. C. N87-11465
N87-11467
MACIEJEWSKI, P. K. N87-11222
MACKEY, H. E., JR. N87-11337
MADER, W. N87-10961
MAETZLER, C. N87-11286
MAFFEO, R. J. N87-11205
MAIANI, L. N87-11586
MAIN, G. L. N87-11575
MAJOR, J. R. N87-11150
MALAGOLI, A. N87-11548
MALCHER, J. N87-11376
MALZAHN, P. N87-11115
MANNING, S. D. N87-11226
MANNSTEIN, H. N87-11456
MANSHADI, F. N87-11047
N87-11048
MANSKE, F. N87-11503
MAO, Y. N87-11292
MARCO, J. N87-10949
N87-10950
N87-10951
N87-10952
N87-10954
MARCON, R. N87-11624
MAREC, J. N87-11609
MARIETTE, V. N87-11302
MARINARI, E. N87-11495
MARLIN, H. W. N87-11047
MARRACHI, G. N87-11301
MARSHALL, F. J. N87-11680
MARSHALL, G. L. N87-10983
MARTIN, M. R. N87-11158
MARTINDALE, W. R. N87-10835
MARTINIS, J. M. N87-11109
MASON, B. N87-11455
MASON, M. L. N87-10870
MASSA, F. N87-11583
MASSONI, J. A. N87-10934
MATHISON, S. N87-10976
MATSUMOTO, J. H. N87-11088
MATSUZAKA, Y. N87-11318
MATTHEWS, J. N87-10916
MAUREL, P. N87-11310
MAXWELL, T. N87-11537
MAYER, H. N87-11429
MAYLE, R. N87-11663
MCCLAIN, E. P. N87-11471
MCCONNELL, J. G. N87-10884
MCCORMICK, M. P. N87-11358
MCCOY, D. A. N87-11097
MCDERMOTT, J. K. N87-11098
MCDONALD, H. N87-11220
MCGARY, M. C. N87-11579
MCGRATH, D. T. N87-11110
MCKNIGHT, R. L. N87-11206
MCLARNON, F. R. N87-11112
MEEKINS, J. F. N87-11594
MEHROTRA, S. C. N87-11179
MEHTA, H. S. N87-11281
MEIBURG, E. N87-11136
MEIER, G. E. A. N87-10844
MEINCKE, J. N87-11380
MELE, B. N87-11585
MELIA, J. N87-11324
N87-11334
MELLO, R. N87-11482
MENSE, H. N87-11500
MERCIER, F. N87-10907
MESERVEY, R. H. N87-11612
METCALFE, J. R. N87-11096
METZ, W. N87-11398
METZNER, G. N87-11648
MEYER-KRAHMER, F. N87-11501
MEYER, H. N87-11149
MICHEL, S. N87-10918
MIDDLEDITCH, J. N87-11662
MILAN, C. N87-10881
MILBERGER, W. E. N87-11107
MILEANT, A. N87-11046
MILIOS, E. E. N87-11513
MILLAN, P. N87-10949
N87-10950
N87-10951
N87-10952
MILLER, L. N87-11087
N87-11103
MILLER, L. F. N87-11147
MILLER, R. A. N87-11195
MILLINGTON, A. C. N87-11325
MILLS, C. T. L. N87-11179
MILLS, W. L. N87-11644
MISHIN, E. V. N87-11355
N87-11605
MITSUMA, H. N87-10920
MIYABAYASHI, M. N87-11059
MOEBIUS, E. N87-11356
MOELLER, C. E. N87-11154
MOELLER, R. P. N87-11152

MOFFAT, R. J. N87-11222
MOHR, F. N87-11148
MOLDOVAN, C. N87-11654
MOODY, M. H. N87-11094
MOORE, J. A. N87-11020
MOORE, W. R. N87-11175
MORAND, H. J. P. N87-10900
N87-10918
MORCRETTE, J. J. N87-11293
MORENO, V. N87-11213
MOREY, W. W. N87-11144
MOROSIN, B. N87-11611
MORRIS, A. S. N87-11169
MORROW, G. N87-11072
MORROW, G. W. N87-11084
N87-11093
MOSKALENKO, A. M. N87-11604
MUEHLBERG, M. N87-11501
MUELLER, G. A. N87-11068
MUELLER, W. N87-11115
MUELLERSCHOEN, R. J. N87-11053
MULARZ, E. J. N87-11200
MURPHY, D. R. N87-11476
MYERS, G. N87-11202

N

NAERT, B. N87-11322
NAKAGAWA, T. N87-10844
NASH, W. P. N87-11360
NATARO, J. N87-10831
NAUCK, J. N87-10857
NELSON, W. D. N87-10973
NERRY, F. N87-11279
N87-11304
NESBITT, J. A. N87-11194
NEUMANN, G. N87-11655
NEVILLE, R. A. N87-11277
NEVIR, P. N87-11418
NEWMAN, B. E. N87-11156
NGUYEN, T. N87-11536
NICHOLSON, W. L. N87-11626
NICOL, M. N87-11671
NICOL, M. F. N87-11670
NIEDERSTADT, G. N87-10966
N87-10967
NIEUWENHUIS, G. J. A. N87-11339
N87-11340
NIEUWENHUIZEN, M. P. N87-10921
NIEUWPOORT, A. M. H. N87-10883
NIGHTINGALE, R. W. N87-11661
NITSCH, P. N87-10971
NJOKU, E. G. N87-11471
NOEL, P. N87-10953
NOOREN, G. J. L. N87-11258

O

OBERLE, L. G. N87-11187
OCHI, T. N87-11318
OCONNOR, D. J. N87-11630
ODONI, A. R. N87-10854
OERY, H. N87-10910
OLSDER, G. J. N87-11171
OLSEN, E. T. N87-11054
OLSON, B. N87-11344
N87-11346
N87-11347
OLSON, E. M. N87-11043
N87-11044
ORAEVSKY, V. N. N87-11355
ORLOFF, K. L. N87-11143
ORTEGA, J. M. N87-11542
OSBORN, M. T. N87-11358
OSBORNE, W. Z. N87-11157
OSHIDA, Y. N87-11215
OSTAFF, D. N87-11330
OSTROGORSKY, A. G. N87-11011
OTOSHI, T. Y. N87-11025
OTTERMANN, J. N87-11271

P

PAGIOLA, E. N87-11583
PAILLOUS, A. N87-10940
N87-10949
N87-10950
N87-10951
N87-10952
N87-10954
PALADIN, G. N87-11548
N87-11564
PALMER, J. M. N87-11292
PALMER, J. M., JR. N87-10974
PANARANDA, F. E. N87-10676
PANTON, R. L. N87-11123
PARISI, G. N87-11495
PARKER, E. R. N87-10996
PARKER, J. K. N87-11174
PARMAR, A. N87-11662
PARTRIDGE, M. E. N87-10656
PASQUELLO, D. N87-11495
PATTERSON, C. W. N87-11674
PATTERSON, S. R. N87-11162
PEARSON, M. G. N87-11568
PEBERDY, R. J. N87-11636
PEELING, S. M. N87-11023
PELITI, L. N87-11547
PELTO, P. J. N87-11489
PERBOS, J. N87-11293
PERIAUX, J. N87-11122
PERINI, J. N87-11059
PERREAU, J. M. N87-11583
PERRON, S. N87-11291
PERRY, L. N. N87-11335
PERSSON, J. G. N87-11166
PETERS, K. A. N87-11142
PETRARCA, S. N87-11585
PFEFFERMANN, E. N87-11649
PFLEGING, P. N87-11149
PHARES, W. J. N87-10835
PHILIPS, P. L. N87-11490
N87-11491
PHILLIPS, A. L. N87-11292
PHIPPS, C. R., JR. N87-11157
PHUCHAROEN, W. N87-11196
PIAU, P. N87-11247
N87-11331
PICARD, P. N87-10941
PIDDUCK, A. J. N87-10984
PIERCE, A. D. N87-11575
PIERSOL, A. G. N87-10905
PIETSCH, W. N87-11678
PIETZNER, B. N87-11435
PILCHER, J. O., II N87-11146
PISTORIUS, H. J. N87-11436
PLAGNE, A. N87-10927
PLATE, K. N87-10857
PLOTARD, P. N87-10940
PLUMMER, M. D. N87-11544
PODAIRE, A. N87-11278
N87-11310
POEHLMANN, K. N87-11013
POPE, L. D. N87-11576
POSNER, E. C. N87-11024
POWERS, W. N87-11063
PREDECKI, P. K. N87-11227
PREMKUMAR, R. I. N87-11053
PRIEDHORSKY, W. N87-11661
N87-11662
N87-11679
N87-11680
PRIEVE, D. C. N87-11621
PROCTOR, J. G. N87-10874
PROGAR, D. J. N87-11010
PROY, C. N87-11270
PSALTIS, D. N87-11596
PUDICK, S. N87-11344
N87-11346
N87-11347
PUGLIESE, A. N87-11588

Q

QINLIANG, W. N87-11463
QUEFFEULOU, P. N87-11241
N87-11248
N87-11249
QUIRK, M. P. N87-11054

R

RAASCH, S. N87-11453
RAATZ, W. E. N87-11370
RABKIN, J. N87-11039
RADTKE, M. N87-11478
RAFFY, M. N87-11253
RAKEM, Z. N87-11609
RALSTON, J. N. N87-10837
RAMAEKERS, J. A. H. N87-11173
RAMAMONJIARISOA, A. N87-11261
RAMANANTSIZEHENA, P. N87-11279
RAMASWAMY, V. G. N87-11212
RAO, S. S. N87-11083
RASCHKE, E. N87-11379
N87-11383
N87-11462
RASHIDNIA, N. N87-10850
RAST, M. N87-11329
RATCLIFFE, S. N87-11568
RATH, A. K. N87-10895
RAYMOND, J. C. N87-11651
RAZZAQ, Z. N87-11178
REAU, J. P. N87-10927
REECE, M. N87-11338
REED, I. S. N87-11040
N87-11041
REED, J. W. N87-11466
REED, S. M. N87-10977
REEVES, J. T. N87-10855
REHBEIN, D. K. N87-11228
REIBALDI, G. G. N87-10993
REID, M. A. N87-11095
REIFSNIDER, K. L. N87-10930
REILINGER, R. E. N87-11357
REILLY, H. F. N87-11027
RENN, J. N87-11623
RENNER, U. N87-10982
REUTER, R. N87-11284
REYNOLDS, J. N87-10918
RHO, M. K. N87-10978
RICHARDS, W. F. N87-11061
RIDD, M. K. N87-11236
RIEBOLD, G. N87-11115
RIELAND, M. N87-11462
RINALDI, M. A. N87-11681
RITCHIE, R. O. N87-10996
ROBACK, R. N87-11201
ROBERTS, A. S., JR. N87-10628
ROBERTS, M. L. N87-11206
N87-11207
ROBERTS, N. C. N87-11601
ROBINSON, D. N. N87-11210
ROBINSON, M. N87-11129
ROBINSON, W. W. N87-11185
ROCKEL, B. N87-11383
RODRIGUEZ-ITURBE, I. N87-11463
ROECKNER, E. N87-11404
ROGALLA, K. N87-11115
ROHDE, J. E. N87-11184
ROKHLIN, V. N87-11515
ROLLIN, E. M. N87-11306
ROMAN, E. N87-11610
ROOS, C. N87-11527
ROSE, R. B. N87-11063
ROSEN, E. N87-11319
ROSNER, D. E. N87-11191
ROSOWSKY, D. N87-10948
ROSSIDES, S. D. N87-11132
ROTH, R. N87-11433
N87-11461
ROTHERY, D. A. N87-11327
ROUVRAIS, F. N87-10918
ROWE, J. E. N87-11478
ROWLEY, W. R. C. N87-11153
ROYER, A. N87-11304
ROZENBLUM, G. N87-10899
ROZHANSKY, V. A. N87-11355
RUDANI, J. P. N87-11312
RUDNER, S. N87-11118
RUPP, H. M. N87-11632
RUPPERSBERG, G. H. N87-11454
RUPRECHT, E. N87-11372
RUSSEL, W. B. N87-11621
RUSSELL, J. N87-11129
RUSSELL, M. D. N87-11039
RUSSO, A. N87-11584
RUSSO, V. N87-11510
RUZHIN, Y. Y. N87-11355
N87-11604
RYCKAERT, J. P. N87-11587

S

SAAD, Y. N87-11514
N87-11531
SABLE, C. N87-10949
N87-10950
N87-10951
N87-10952
SACH, E. D. N87-10925
N87-10939
SAGDEEV, R. Z. N87-11355
SAID, F. N87-11242
N87-11244
N87-11250
SAITO, G. N87-11328
SALAS-ROCHE, F. N87-10654
SALOMONSON, V. V. N87-11296
SANBORN, J. C. N87-11534
N87-11535
N87-11536
SANZ-SERNA, J. M. N87-11563

SASTRY, S. S. N87-11572
SATORIUS, E. H. N87-11050
SAUSEN, R. N87-11402
SAVOUILLAN, R. N87-10890
SCATTOLINI, R. N87-11519
N87-11539
SCHAEFER, B. N87-10990
SCHAEFER, D. W. N87-11012
SCHANDA, E. N87-11255
N87-11299
SCHATZMANN, M. N87-11431
N87-11432
SCHAWER, J. N87-10881
SCHEER, D. D. N87-10959
SCHERRER, P. H. N87-11677
SCHGOUNN, C. N87-10955
N87-11290
SCHIELE, G. N87-11505
SCHINKO, I. N87-11501
SCHLECHTENDAHL, E. G. N87-11134
SCHLOSS, R. N87-11391
SCHMETZ, J. N87-11455
SCHMIDL, H. N87-11133
SCHMIDT, H. N87-11410
SCHMIDT, R. A. N87-11488
SCHMITZ, H. D. N87-10982
SCHMUGGE, T. J. N87-11294
SCHNATTINGER, W. N87-11655
SCHNEIDER, U. N87-11377
SCHOENFELDER, V. N87-11650
SCHOENWIESE, C. D. N87-11369
N87-11371
SCHOLER, M. N87-11356
SCHONFELD, W. N87-11230
SCHRAMM, D. N. N87-11663
SCHRODIN, R. N87-11411
SCHUELLER, P. G. N87-11068
SCHULLER, I. K. N87-11598
SCHULTZ, D. F. N87-11181
N87-11345
SCHULTZ, M. H. N87-11531
SCHUMACHER, J. M. N87-11559
SCHUMANN, U. N87-11410
SCHURINGA, H. H. N87-11568
SCHWARZ, A. N87-11115
SCHWARZ, F. C. N87-11116
SCINTO, L. F. N87-11483
SCOTT, B. R. N87-11160
SEASHOLTZ, R. G. N87-11187
SEGER, G. N87-10881
SELLERS, P. J. N87-11294
SELTZER, S. M. N87-11589
SENGER, K. H. N87-10933
SERAUDIE, A. N87-10834
SERVA, M. N87-11625
SESSIONS, R. L. N87-11154
SEVESTRE, C. N87-11019
N87-11131
SGUBINI, S. N87-10901
SHAHSHAHANI, M. N87-11037
SHAMROTH, S. J. N87-11220
SHAU, D. H. N87-11059
SHEFFLER, K. N87-11199
SHEN, D. H. N87-11063
SHEN, T. C. N87-11669
SHEPARD, R. L. N87-11147
SHINYA, N. N87-10993
SHYU, H. C. N87-11041
SIEDLER, G. N87-11423
SIEV, B. N87-11039
SIFFRE, J. N87-10949
N87-10950
N87-10951
N87-10952
SIM, A. G. N87-10871
SIMON, M. N87-11046
SIMONETT, D. N87-11237
SIMPSON, R. W. N87-10854
SLIVINSKI, T. N87-11507
SMITH, B. T. N87-10972
SMITH, K. S. N87-10984
SMITH, M. J. T. N87-11578
SMITH, M. L. N87-11112
SMITH, R. A. N87-11076
SMITHRICK, J. J. N87-11095
SNOEIJ, P. N87-11246
SNYDER, P. K. N87-11143
SNYDER, R. F., JR. N87-11145
SOEHNE, M. N87-11502
SOLOMON, J. N87-11054
SOMIESKI, F. N87-11456
SOMMELJER, B. P. N87-11561
SOMOANO, R. B. N87-11083
SOPPER, P. N87-11115
SOROCKY, S. J. N87-10912
SOVERS, O. J. N87-11055
SPALDING, D. B. N87-11130
SPASYK, M. A. N87-11349
SPENCER, P. N. N87-10996
SPETH, P. N87-11372
SPILLAR, E. J. N87-11658
SPILLER, E. N87-11598
SPILLING, P. D. N87-11615
SPIRADEK, K. N87-11232
SRIDHAR, S. N87-11348
SRINIVASAN, R. N87-11202
ST.CYR, O. C. N87-11675
STAENZ, K. N87-11271
STAHLMANN, J. N87-11426
STAMM, H. N87-11135
STANLEY, M. N87-11498
STANLEY, W. D. N87-11105
STATMAN, J. I. N87-11032
N87-11033
STAVRINIDIS, C. N87-10890
STEINMANN, A. N87-11623
STELLA, B. N87-11582
STELLA, L. N87-11662
STEPHENS, C. O. N87-10974
STEPHENS, J. J., JR. N87-10999
STEPHENS, S. A. N87-11055
STEVEN, M. D. N87-11272
N87-11306
STEVENS, N. J. N87-10946
STEWART, E. C. N87-10843
STEYERT, W. A. N87-11164
STOCKMAN, H. W. N87-11338
STOCKWELL, A. E. N87-11177
STOLL, M. P. N87-11279
STONE, D. E. W. N87-11176
STONE, E. C. N87-11672
STOTZER, E. N87-11299
STOUFFER, D. C. N87-11216
STRAMMA, L. N87-11427
STRANGE, R. R. N87-11186
STRANGMAN, T. E. N87-11197
STREETT, C. L. N87-11125
STREHMEL, K. N87-11561
STROBEL, O. N87-11148
STUCKENBERG, H. U. N87-11395
N87-11442
STUHLMANN, R. N87-11379
SUBBARAO, S. N87-11081
SUIT, W. T. N87-10869
SUME, A. N87-11341
SUN, G. Z. N87-11537
SUTTON, J. O. N87-10974
SWANSON, G. A. N87-11218
SWANSON, L. N87-11037
SYKES, G. F. N87-10977
SZEJWACH, G. N87-11307
SZTAJNO, M. N87-11678

T

TAKAHASHI, K. N87-11287
TAMAIN, G. N87-11323
TANRE, D. N87-11293
N87-11363
TAWFIQ, M. A. N87-11311
TAYLOR, L. W., JR. N87-10945
TAYLOR, R. D. N87-11606
TEDROW, P. M. N87-11612
TEETER, R. N87-11478
TEILLAT, P. M. N87-11330
TEILLET, P. N87-11304
TEILLET, P. M. N87-11269
TENHAVE, A. A. N87-10893
TETZLAFF, G. N87-11438
THACKER, W. C. N87-11382
THALLER, L. H. N87-11086
THART, W. G. J. N87-11004
THEIL, M. H. N87-11006
THELIN, B. N87-10989
N87-11361
N87-11362
THOMAS, M. A. N87-11077
THOMAS, M. M. N87-11534
N87-11535
N87-11536
THOMPSON, D. C. N87-11165
THOMPSON, R. B. N87-11228
THOMPSON, R. L. N87-11209
THORNTON, C. L. N87-11055
THUMM, M. N87-11068
TIEGS, T. N. N87-10980
TILL, S. N87-11304
TIMM, R. N87-10844
TIMMERMAN, P. J. N87-11092
TODD, E. S. N87-11208
TODD, J. A. N87-10996
TOMBESI, P. N87-11599
TORAK, W. N87-11070
TORBERT, R. B. N87-11676
TOURNIER, R. N87-10982
TRAUTMANN, T. N87-11412
TREUMANN, R. A. N87-11355
N87-11604
N87-11605
TRIPICCIONE, R. N87-11495
TROCLET, B. N87-10906
TRUBERT, M. N87-10926
TRUEMPER, J. N87-11678
TRUONG, T. K. N87-11040
N87-11041
TURGEL, R. S. N87-11151
TURNBERG, J. E. N87-10840
TURNER, E. R. N87-11219
TURPEINEN, O. N87-11455
TWARDY, H. N87-10969

V

VAANDRAGER, F. W. N87-11064
VACHON, G. N87-11291
VANDELUSTGRAAF, B. N87-11235
VANDERGEEST, P. J. J. N87-10863
VANDERHOEVEN, G. F. N87-11550
VANDERHOFF, J. A. N87-10966
VANDERHOUWEN, P. J. N87-11561
VANDERMAST, C. N87-11528
VANDERMATTEN, M. N87-11568
VANDERVORST, H. A. N87-11555
VANDERWIJNGAART, R. F. N87-11172
VANEIJK, P. N87-11523
N87-11633
VANGELDEREN, J. A. N87-11138
VANHERWAARDEN, J. P. N87-10893
VANHOEVE, F. A. N87-11524
N87-11526
VANLEER, B. N87-11558
VANOMMERING, G. N87-11075
N87-11101
VANPARADIJS, J. N87-11678
VANSTOKKOM, H. T. C. N87-11305
VANSTONE, R. H. N87-11212
N87-11214
VANSWIETEN, A. C. M. N87-10928
VARNER, M. O. N87-10835
VEDRENNE, M. N87-10887
VEESER, L. R. N87-11573
VENTURINI, E. L. N87-11611
VERBEQUE, V. N87-11302
VERBRUGGHE, M. N87-11301
VERDONK, P. L. F. M. N87-11069
VEREZ, B. N87-10892
VERHOEF, W. N87-11262
VERMANDE, P. N87-11276
VERMEER, L. J. N87-10845
VERREAULT, R. N87-11291
VERWER, J. G. N87-11560
N87-11563
VEUGEN, L. M. M. N87-11305
VICCARO, P. J. N87-11598
VIDAL, C. N87-10906
VIEHOFF, T. N87-11457
VIG, J. R. N87-11018
VIGNERON, F. R. N87-10912
VILLALAZ, P. N87-10902
VIOLLIER, M. N87-11282
VISSER, H. G. N87-10858
VISWANATHAN, R. N87-10946
VITEK, E. J. N87-11145
VOGEL, B. N87-11458
VOGEL, J. A. N87-11482
VOGELMANN, V. N87-11501
VOLKERT, H. N87-11410
VOLLOR, T. N87-10877
VONFINCKENSTEIN, K. G. F. N87-11552
VONSTORCH, H. N87-11405
N87-11406
VOSEN, S. R. N87-10988
VULPIANI, A. N87-11548
N87-11564
VUNCK, D. S. N87-11154

W

WACKER, U. N87-11421
WADA, B. K. N87-10922
WADE, D. C. N87-10888
WADSWORTH, A. N87-11331
WAGEMAKER, C. N87-11065
WALCZEWSKI, J. N87-11459
WALKER, G. N87-11627

WALKER, J. N87-11129
WALKER, K. P. N87-11217
WALKLEY, K. B. N87-10829
WALLACE, R. J. N87-11051
WAMSER, C. N87-11394
WAMSER, M. N87-11407
N87-11430
WANG, B. F. N87-11061
WANG, C. L. N87-11344
N87-11346
N87-11347
WANG, D. N87-11516
WANHILL, R. J. H. N87-11233
WATKINS, W. B. N87-11185
WEAR, J. D. N87-11204
WEBB, J. N87-11507
WEBER, K. H. N87-11368
N87-11460
WEHRY, W. N87-11437
WEIKLE, D. H. N87-11187
WEINBERG, B. C. N87-11220
WEINER, R. N87-11561
WEINGAERTNER, H. N87-11378
WEIRICK, L. J. N87-11338
WEISBIN, C. R. N87-11494
WELLS, J. G. N87-11105
WENDLING, P. N87-11384
WENZEL, M. N87-11425
WERTH, J. N87-11344
N87-11346
N87-11347
WESTER, K. N87-11332
WESTRICH, H. R. N87-11338
WHELAN, J. A. N87-11344
N87-11346
N87-11347
WHITE, C. N87-11202
WHITE, N. N87-11662
WHITFIELD, D. L. N87-11128
WIECKO, C. N87-11610
WIEGNER, M. N87-11379
WIESEMANN, W. N87-11285
WIJKER, J. J. N87-10928
WILBY, J. F. N87-10905
WILCK, H. C. N87-11050
WILCOX, R. C. N87-10998
WILD, C. N87-11507
WILHELM, R. N87-11068
WILLIAMS, B. G. N87-11055
WILLIAMS, P. J. N87-10943
WILLIAMSON, H. D. N87-11315
WILLMES, A. C. N87-10875
WILSON, J. R. N87-11663
WILSON, J. W. N87-11589
WINKLER, L. N87-11532
WINKLER, P. N87-11450
WINNICK, J. N87-11112
WINTER, P. U. N87-11039
WIPPERMANN, F. N87-11413
WISTROM, R. E. N87-10997
WITTEVEEN, C. N87-11541
WITTICH, K. P. N87-11461
WOLF, R. A. N87-11359
WOLFE, W. J. N87-11536
WOLFF, M. T. N87-11667
WOLLENWEBER, F. N87-11388
WRIGHT, J. R. N87-10904
WRIGHT, P. M. N87-11236
WRIGHT, S. M. N87-11061
WU, S. C. N87-11055
WULFF, G. N87-11525

X

XIAO, J. K. N87-11289

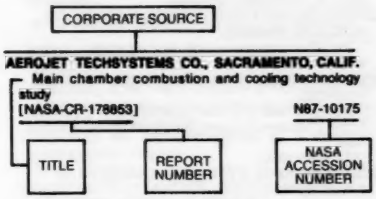
Y

YANG, B. L. N87-11308
YANG, J. N. N87-11226
YANG, R. J. N87-11220
YASUDA, Y. N87-11287
N87-11328
YAU, J. F. N87-11214
YEN, S. P. S. N87-11083
YENNI, K. R. N87-10843
YI, T. Y. N87-11090
YOKOI, S. N87-10993
YORK, T. M. N87-11607
YOUNG, E. W. A. N87-11002
YOUNG, T. H. N87-11234
YUEN, H. P. N87-11599

Z

ZAJAC, W. V. N87-11077
ZANIFFE, O. Z. N87-11307
ZBINDEN, R. M. N87-11283
ZDUNKOWSKI, W. N87-11387
N87-11411
N87-11412
ZHAO, G. N87-11383
ZIEGLER, E. N87-11598
ZILGER, J. N87-11296
ZIMMERMAN, G. A. N87-11050
ZIMMERMANN, R. N87-10942
ZUKOSKI, E. E. N87-10992

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACADEMIA SINICA, GUIYANG (CHINA).
Microwave dielectric properties of minerals and rocks N87-11289
Spectral study of rocks and some iron deposits from Eastern China N87-11308
Spectral features of rocks and minerals from Beiyunobo region and metallogenetic forecast for REE in the central part of Inner Mongolia N87-11333

AERITALIA S.P.A., TORINO (ITALY).
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2
[ESA-CR(P)-2219] N87-10880
Bubble Drop and Particle Unit (BDPU) project
[BO-RP-AI-004] N87-11016

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Relevance of short fatigue crack growth data for durability and damage tolerance analyses of aircraft
[FFA-TN-1986-23] N87-11231
Grid generation around car configurations above a flat ground plane using transfinite interpolation
[FFA-139] N87-11545

AEROSPACE CORP., EL SEGUNDO, CALIF.
Millimeter-wave range for the quick evaluation of large reflector antennas with complex feeds
[AD-A168161] N87-11060
Aerospace nickel-cadmium cell separator qualifications program N87-11085
Nickel hydrogen low Earth orbit life testing N87-11102

AEROSPACE CORP., LOS ANGELES, CALIF.
Self-discharge characteristics of spacecraft nickel-cadmium cells at elevated temperatures N87-11088

AGRICULTURAL UNIV., POZNAN (POLAND).
Relation between soil moisture tension and spectral reflectance of different soil in visible and near-infrared range N87-11314

AIR FORCE ACADEMY, COLO.
Visualization of three-dimensional forced unsteady separated flow
[AD-A168939] N87-11129

AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.
Sodium-sulfur batteries for spacecraft energy storage N87-11074

AIR FORCE ARMAMENT LAB., EGLIN AFB, FLA.
Three-dimensional unsteady Euler equations solutions on dynamic grids
[AD-A168041] N87-11128

AIR FORCE HUMAN RESOURCES LAB., BROOKS AFB, TEX.
Low-cost avionics simulation for aircrew training
[AD-A169198] N87-10865

AIR FORCE TEST PILOT SCHOOL, EDWARDS AFB, CALIF.
Performance and quality flight test textbook. Volume 2: Flying qualities
[AD-A168124] N87-10830

AIR PRODUCTS AND CHEMICALS, INC., ALLENTOWN, PA.
Conceptual design of GTA-1 neutralizer cryopump
[DE86-011759] N87-11164

AKRON UNIV., OHIO.
High-temperature constitutive modeling N87-11210

ALABAMA UNIV., HUNTSVILLE.
International Solar-Terrestrial Program Data Processing Consortium
[NASA-CR-178919] N87-11676

ALFRED-WEGENER-INST. FOR POLAR RESEARCH, BREMERHAVEN (WEST GERMANY).
Physical processes in the atmospheric boundary layer at the pack-ice border N87-11394

AMERICAN WELDING INST., LOUISVILLE, TENN.
Study of the status and potential of high energy beam welding in shipyard construction
[AD-A169281] N87-11161

AMES LAB., IOWA.
Using acoustic waves for the characterization of closed fatigue cracks
[DE86-011404] N87-11228

AMT FUER WEHRGEOPHYSIK, TRABEN-TRARBACH (WEST GERMANY).
A method for correlation analysis in climatology N87-11378
The evaporation of several types of vegetation and its modeling by a simple inventory climate model N87-11388
Operational mesoscale ceiling analysis and forecasting using statistical climatological methods N87-11436

ANALEX CORP., DAYTON, OHIO.
Experimental verification of vapor deposition model in Mach 0.3 burner rigs N87-11192

ANALYTICAL MECHANICS ASSOCIATES, INC., HAMPTON, VA.
Summary of shuttle data processing and aerodynamic performance comparisons for the first 11 flights
[NASA-CR-172440] N87-10884

ANT NACHRICHTENTECHNIK, BACKNANG (WEST GERMANY).
Development of equipment for the 20/30 GHz payload of a satellite for propagation and transmission experiments
[BMFT-FB-W-85-035] N87-10948

ARGONNE NATIONAL LAB., ILL.
Guide to sharing personal computer resources via local area networks
[DE86-009685] N87-11532
Stability of multilayers for short-wavelength optics
[DE86-012129] N87-11598

ARIANESPACE, EVRY (FRANCE).
Results of Ariane launch vehicle flights and their effects on the sizing of satellite structures N87-10887

ARIZONA UNIV., TUCSON.
Reconstruction of vegetation spectra from soil plant canopies N87-11268
Absolute calibration of remote sensing instruments N87-11292

ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
Reports of the US - USSR Weddell polynya expedition, October-November 1981. Volume 8: Collected reprints
[AD-A169346] N87-11476

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Pavement recycling: Facilities Technology Application Test (FTAT) demonstration, FY 84, Fort Gillem, Georgia
[AD-A169284] N87-10877

ARMY LAB. COMMAND, FORT MONMOUTH, N.J.
UV/ozone cleaning of surfaces
[AD-A169024] N87-11018

ARMY MILITARY PERSONNEL CENTER, ALEXANDRIA, VA.
Evaluation of improvements to Brayton cycle performance
[AD-A169018] N87-11349

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.
Real-time pattern recognition using a modified liquid crystal television in a coherent optical correlator
[AD-A169042] N87-11595

ARMY RESEARCH INST. OF ENVIRONMENTAL MEDICINE, NATICK, MASS.
Prediction of the metabolic cost of exercise from measurements during recovery
[AD-A168078] N87-11482

ARMY WAR COLL., CARLISLE BARRACKS, PA.
The strategic defense initiative
[AD-A168147] N87-11644

ASSISTANT SECRETARY OF DEFENSE (ACQUISITION AND LOGISTICS), WASHINGTON, D.C.
Model designation of military aerospace vehicles
[PB86-222429] N87-10831

ASTRON RESEARCH AND ENGINEERING, SANTA MONICA, CALIF.
Acoustic load considerations for spacecraft structures N87-10905

AUBURN UNIV., ALA.
Effect of strain rate and temperature on the properties of (Fe,Ni) V long range ordered alloys
[DE86-011967] N87-10998

B

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Electrical conductivity measurements of hydroxylammonium nitrate: Design considerations
[AD-A168138] N87-10998
A fast response thermal conductivity gage
[AD-A168165] N87-11145
Radial expansion of cavities produced by the axisymmetric steady penetration of hypervelocity rods
[AD-A168186] N87-11160

BATTELLE COLUMBUS LABS., OHIO.
Current Awareness Bulletin: Metals and Ceramics
[CAB-160] N87-10995

BATTELLE INST., FRANKFURT AM MAIN (WEST GERMANY).
Solid Earth satellite: Market, cost and benefits study
[ESA-CR(P)-2213-VOL-1] N87-11638
Solid Earth satellite: Market, cost and benefits study
[ESA-CR(P)-2213-VOL-2] N87-11639

BERN UNIV. (SWITZERLAND).
Microwave modeling of snow and soil N87-11255
Can microwave signatures be used to retrieve the water equivalent of a dry snow pack? N87-11286
Calibrated microwave signature measurements of soil and wheat N87-11299

BIHRLE APPLIED RESEARCH, INC., JERICHO, N. Y.
Low speed rotary aerodynamics of F-18 configuration for 0 deg to 90 deg angle of attack: Test results and analysis
[NASA-CR-3808] N87-10836
Rotary balance data and analysis for the X-29A airplane for an angle-of-attack range of 0 deg to 90 deg
[NASA-CR-3747] N87-10837

BOEING AEROSPACE CO., KENNEDY SPACE CENTER, FLA.
Orbital transfer vehicle launch operations study: Automated technology knowledge base, volume 4
[NASA-CR-179706] N87-10883

BONN UNIV. (WEST GERMANY).
Variations of the water vapor content in the lower troposphere between 20 deg N and 20 deg S during the last 20 years N87-11368
North Atlantic Oscillation (NAO) in ground pressure and its significance for the Atlantic-European area N87-11374
Measurement of subscale climatological processes by diagnosis of scaled budgets N87-11381

Investigation of the aperiodic behavior of the Southern Oscillation using methods of nonlinear systems analysis N87-11422
The variability of sea surface temperatures N87-11460

BORER ELECTRONICS A.G., SOLOTHURN (SWITZERLAND).
Study of the feasibility of a channel multiplexer operating at cryogenic temperatures
[RPT/CRY/62351/BO] N87-11654

BRITISH AEROSPACE AIRCRAFT GROUP, BRISTOL (ENGLAND).
A bibliography of aerodynamic heating references
[BAE-BT-13481] N87-10832
Prop-fan slipstream effects using static simulators: Low speed task, phase 1
[BAE-B59R/R-D/610/13498] N87-10875
International Conference - Superplasticity in Aerospace Aluminium
[BAE-S85/AMR/0066] N87-10994

BRITISH AEROSPACE AIRCRAFT GROUP, WARTON (ENGLAND).
Details of low speed intake test facility at the Warton 2.7m x 2.1m wind tunnel
[BAE-AXM127] N87-10873
Practical evaluation of wall pressure signature correction methods in the 2.7m x 2.1m low speed wind tunnel
[BAE-ARG-204] N87-10874

BRITISH AEROSPACE DYNAMICS GROUP, BRISTOL (ENGLAND).
HPSA: High Power Solar Array study
[BAE-TP-8071] N87-11352

BRITISH AEROSPACE PUBLIC LTD. CO., BRISTOL (ENGLAND).
Radiation hardness assurance of electronic components, with special reference to semiconductor devices and evaluation statistics
[BAE-BT-13801] N87-11113
Varactor tuned X-band FET oscillator
[BAE-BT-14500] N87-11114
Electro-rheological fluids. A brief description and typical applications
[BAE-BT-13744] N87-11132
A summary of gas shielded arc welding
[BAE-BT-14107] N87-11167
Performance characteristics of a low speed hydraulic motor driving a position control system
[BAE-BT-14978] N87-11168
THe effects of terrain clutter on observer behaviour during search of complex scenery
[BAE-BT-13535] N87-11484
Air-to-ground target acquisition in the presence of sensor vibration
[BAE-BT-14222] N87-11485
An experimental design for colour sensitivity in target acquisition
[BAE-BT-12469-VOL-1] N87-11490
An experimental design for colour sensitivity in target acquisition, volume 2
[BAE-BT-12469-VOL-2] N87-11491
Computer program TRAMP: Further extensions
[BAE-BT-13621] N87-11520
Passive stereoscopic rangefinder
[BAE-BT-12300] N87-11600
Application of the spoke filter to digital IR images
[BAE-BT-13966] N87-11601

BRITISH AEROSPACE PUBLIC LTD. CO., STEVENAGE (ENGLAND).
Technology demonstration programme, phase 2 study
[BAE-TP-8207] N87-10885

BRITISH AIRCRAFT CORP., FILTON (ENGLAND).
The design analysis and verification of a satellite N87-10916
Spacecraft structural acoustics: Progress in vibration level prediction N87-10943

BRITISH PETROLEUM CO. LTD., LONDON (ENGLAND).
Catalytic production of carboxylic acids or anhydrides from olefins
[GB-PATENT-2-140-004-A] N87-10983

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Use of molten salt electrochemical techniques to study and control hydrogen storage in metal hydrides
[DE86-011534] N87-11015
Anaerobic microbial transformations in subsurface environments: Highlights
[DE86-006703] N87-11480
Crystallography of icosahedral crystals
[DE86-009945] N87-11613

BURTON TECHNOLOGIES, INC., RALEIGH, N.C.
Control of surface attack by gallium alloys in electrical contacts
[AD-A168168] N87-11108

C

CALIFORNIA INST. OF TECH., PASADENA.
Combustion in turbulent jets and buoyant flames
[PB86-203205] N87-10992
Optical filtering techniques
[AD-A168084] N87-11596
On the chemical composition of interstellar molecular clouds: A millimeter and submillimeter spectral line survey of OMC-1 N87-11665
Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere
[NASA-CR-179863] N87-11672

CALIFORNIA UNIV., BERKELEY.
Design of low alloy steels for thick walled pressure vessels
[DE86-011748] N87-10996
Inaugural Conference of the Berkeley Research Group in Nonlinear Systems and Dynamics
[AD-A169175] N87-11572
Development of a CCD camera for an automated supernova search and observations of a supernova in NGC 5033 N87-11660

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Calculating and predicting the properties of materials
[DE86-011557] N87-10964
Heat transfer during laminar flow flame quenching: Effect of fuels
[DE86-007490] N87-10988
Stability of a vitreous electrolyte for possible use in high-temperature lithium/sulfur cells
[DE86-011563] N87-11112

CALIFORNIA UNIV., DAVIS.
Landsat D Thematic Mapper image dimensionality reduction and geometric correction accuracy
[NASA-CR-179876] N87-11336

CALIFORNIA UNIV., LOS ANGELES.
Controlling the temporal structure of limb movements: A response
[AD-A169261] N87-11488
Types and properties of planetary tori and limit on mass loss from satellites N87-11666
High pressure cosmochemistry applied to major planetary interiors: Experimental studies
[NASA-CR-177188] N87-11670
The ammonia-water phase diagram and its implications for icy satellites
[NASA-CR-179861] N87-11671

CALIFORNIA UNIV., SANTA BARBARA.
Canopy reflectance modeling in a tropical wooded grassland
[NASA-CR-179895] N87-11237
Spectral signature of snow in visible and near-infrared wavelengths N87-11316

CANADA CENTRE FOR REMOTE SENSING, OTTAWA (ONTARIO).
The C and Ku band scatterometer results from Canadian participation in the ESA PROMESS ocean measurement campaign N87-11252
Geometric model simulations of conifer canopy reflectance N87-11269
Narrow-band multispectral imagery of the vegetation red reflectance edge for use in geobotanical remote sensing N87-11277
Spectral measurements of tree defoliation N87-11330

CANADIAN ASTRONAUTICS LTD., OTTAWA (ONTARIO).
A high reliability battery management system N87-11094
Lightweight, direct-radiating nickel hydrogen batteries N87-11096

CENTER FOR MATHEMATICS AND COMPUTER SCIENCE, AMSTERDAM (NETHERLANDS).
Euler flow solutions for a transonic wind tunnel section
[CWI-NM-R8601] N87-10847
Verification of two communication protocols by means of process algebra
[CWI-CS-R8608] N87-11064
Multigrid approaches to the Euler equations
[CWI-NM-R8602] N87-11140
A note on monoticity of a Rosenbrock method
[CWI-NM-R8606] N87-11551
Linear stability of the hopecotch scheme
[CWI-NM-R8603] N87-11560
On the numerical integration of second-order initial value problems with a periodic forcing function
[CWI-NM-R8604] N87-11561
The order of B-convergence of algebraically stable Runge-Kutta methods
[CWI-NM-R8607] N87-11562
Convergence analysis of one-step schemes in the method of lines
[CWI-NM-R8608] N87-11563

CENTRAL BUREAU OF STATISTICS, VOORBURG (NETHERLANDS).
Aviation statistics, 1984
[ISBN-90-357-0386-3] N87-10851

CENTRAL ELECTRICITY GENERATING BOARD, LONDON (ENGLAND).
Effect of creep damage on fatigue life of Cr-Mo-V steel
[BLL-CE-TRANS-8212-(9022.09)] N87-10963

CENTRE D'ETUDE SPATIALE DES RAYONNEMENTS, TOULOUSE (FRANCE).
The effect of electromagnetic wave polarization on wave attenuation in a vegetation canopy N87-11257

CENTRE D'ETUDES ET DE RECHERCHES, TOULOUSE (FRANCE).
Report on tests of a CAST 10 airfoil with fixed transition in the T2 transonic cryogenic wind tunnel with self-adaptive walls
[RT-OA-63/1685] N87-10834

CENTRE NATIONAL D'ETUDES SPATIALES, PARIS (FRANCE).
Launcher-payload dynamic interaction N87-10900
Low frequency response of axisymmetric structures to random noise N87-10906
Feasibility study of a launcher vibration environment simulator N87-10918

CENTRE NATIONAL D'ETUDES SPATIALES, TOULOUSE (FRANCE).
Prediction and correlation of structural response in acoustic chambers N87-10907
Study of the performances of SEASAT satellite over ice and sea ice
[CNES-CS/MM/82/117/CT/GRGS] N87-10955
In-flight calibration during PROMESS campaign N87-11245
Wind tunnel investigation of the characterization of radar backscattering by different wave fields N87-11261
Influence of topography and the atmosphere on radiometric measurements in mountainous regions: Tests of a signal inversion model on Landsat Thematic Mapper (TM) data N87-11270
High-spectral resolution remote sensing instruments developed and under development at CNES N87-11276
Microwave signatures of sea ice in the Fram strait (Greenland) in summer N87-11290

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MONTPELLIER (FRANCE).
Effect of architectural parameters and radiative conditions on the remote sensing of the leaf index of vegetation canopies N87-11267
Analysis of SPOT simulation radiometric measurements in arid and subhumid Mediterranean environments N87-11313

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, STRASBOURG (FRANCE).
Determination of land surface parameters by satellite and associated inverse problems N87-11253

CENTRUM VOOR LANDBOUWPUBLIKATIES EN LANDBOUWDOCUMENTATIE, WAGENINGEN (NETHERLANDS).
Remote sensing methods to determine the vitality of vegetation
[LITERATUUROVERZICHT-42] N87-11235

CHIBA UNIV. (JAPAN).
In-vivo chlorophyll determination of plants by laser-induced fluorometer N87-11287
Nutritional diagnosis for plant by field spectroradiometer N87-11328

CHRISTOPHER NEWPORT COLL., NEWPORT NEWS, VA.
Determination of the ultrasonic properties of composites
[NASA-CR-179799] N87-10972

CINCINNATI UNIV., OHIO.
Constitutive modeling of inelastic anisotropic material response N87-11216

CIRRUS COMPUTERS LTD., FAREHAM (ENGLAND).
Investigation of optimal complexity of BITE and its effects on reliability, maintainability, monitoring and fault prediction
[ETN-86-97976] N87-11175

CISIGRAPH, RUNGIS (FRANCE).
Fluid-structure interaction: Modal synthesis method N87-10899

CLEMSON UNIV., S.C.
Characterization and control of object acquisition using a robot hand N87-11174

CLEVELAND STATE UNIV., OHIO.
Mechanical behavior of thermal barrier coatings for gas turbine blades N87-11196

COLLEGE OF WILLIAM AND MARY, WILLIAMSBURG, VA.
Characterization of the relationship of the cure cycle chemistry to cure cycle processing properties [NASA-CR-177058] N87-11007
COLOGNE UNIV. (WEST GERMANY).
Accuracy analysis of satellite experiments for the measurement of the radiation budget N87-11379
Modeling of radiation and cloud characteristics for models of general circulation and climate N87-11383
COLUMBIA UNIV., NEW YORK.
Observations of coronal X-ray sources and an analysis of the stellar contribution to the soft X-ray background N87-11656
COMMISSARIAT A L'ENERGIE ATOMIQUE, ALGIERS (ALGERIA).
Modeling of the relation between air temperature and surface temperature for the spatial extension of surface parameter analysis models N87-11266
COMMITTEE ON APPROPRIATIONS (U. S. SENATE).
NASA Space Program [S-HRG-99-691] N87-11642
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION (U. S. SENATE).
National Aeronautics and Space Administration Authorization Bill, 1986 [H-REPT-99-829] N87-11641
COMMITTEE ON SCIENCE AND TECHNOLOGY (U. S. HOUSE).
National Aeronautics and Space Administration Authorization Act, 1987 [H-REPT-99-829] N87-11640
The 1987 NASA authorization, volume 1 [GPO-60-960] N87-11643
CONNECTICUT UNIV., STORRS.
Biaxial constitutive equation development N87-11217
CONSIGLIO NAZIONALE DELLE RICERCHE, ROME (ITALY).
An alternative model for the density of states in the Quantum Hall Effect [NOTA-INTERNA-858] N87-11624
CORNELL UNIV., ITHACA, N.Y.
The dynamically compressed metallic state: Theory [AD-A169174] N87-11620
Far-infrared spectral studies from the G. P. Kuiper Airborne Observatory [NASA-CR-179879] N87-11652

D

DEFENSE TECHNICAL INFORMATION CENTER, ALEXANDRIA, VA.
An assessment of CD ROM (Compact Disk Read Only Memory) [AD-A169259] N87-11492
DENVER UNIV., COLO.
Measurement of stress distributions in adhesive bonded joints [AD-A169178] N87-11227
DEPARTMENT OF CIVIL ENGINEERING, INDORE (INDIA).
Radiometric data characterize quantization of soil forming minerals N87-11281
DEPARTMENT OF ENERGY, WASHINGTON, D. C.
Automotive Technology Development Program [DE86-010883] N87-11163
Programs of the Office of Energy Research [DE86-009937] N87-11646
DEPARTMENT OF THE AIR FORCE, WASHINGTON, D.C.
Tropospheric scatter communication system having angle diversity [AD-D012263] N87-11058
Wavelength selective demultiplexer tuner [AD-D012264] N87-11106
Miniature high performance pulsed modulator apparatus [AD-D012266] N87-11107
Radiofrequency amplifier based on a dc superconducting quantum interference device [AD-D012353] N87-11109
Radiation upset threshold detector apparatus [AD-D012260] N87-11145
Method and apparatus for high speed, sustained recording of infrared laser beam patterns [AD-D012265] N87-11154
Optical flip-flop system [AD-D012259] N87-11583
DEPARTMENT OF THE NAVY, WASHINGTON, D. C.
Analog fiber gyro with extended linear range [2339212320] N87-11152
Polynomial grating [AD-D012313] N87-11594
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK (WEST GERMANY).
The high speed cascade wind tunnel: Still an important test facility for investigations on turbomachinery blades [DFVLR-MITT-86-11] N87-10878
Analysis of long thin-walled tubes N87-10895
The K1-K2 interaction for matrix splitting in unidirectional laminates of carbon fiber reinforced epoxy N87-10932
Performance characteristics of composite materials N87-10935
Optimization of axially compressed CFRP cylinders N87-10942
Advanced composites for lightweight structures N87-10966
Environmental influences on CFRP N87-10967
The influence of moisture and temperature on the strength behavior of CFRP N87-10968
Choice of resin when using different carbon fiber types N87-10969
The interface between fiber and matrix resin from a chemical point of view N87-10970
Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP N87-10971
Digital data recording on floppy disks applied for on-board use in helicopters [DFVLR-MITT-86-10] N87-11149
Interactive data analysis [DFVLR-MITT-86-07] N87-11525
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, COLOGNE (WEST GERMANY).
European utilization aspects of low Earth orbit space station elements, phase 3, volume 2 [ESA-CR(P)-2219] N87-10880
Experimental verification of rocket exhaust plumes and impingement effects on spacecraft surfaces [DFVLR-IB-22-85-A-29] N87-10961
Galvanic corrosion between carbon fiber reinforced plastics and metallic aeronautical materials [DFVLR-FB-86-16] N87-11003
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, GOETTINGEN (WEST GERMANY).
Verification of the mathematical model of the Ariane 4 payload fairing by means of extended modal survey testing N87-10902
Applying modal survey test results for updating dynamic mathematical models of spacecraft structures N87-10914
Experience on the Olympus modal survey test N87-10919
Advanced method for computing the flow around wings with rear separation and ground effect [DFVLR-FB-86-17] N87-11017
Numerical simulation of the formation of two and three-dimensional structures in shear layers and wakes [DFVLR-FB-86-10] N87-11136
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN (WEST GERMANY).
Optimal control: A systematic aid for the computer aided exploration of the dynamic possibilities of a cryogenic wind tunnel [DFVLR-FB-86-23] N87-10879
Debonding analysis of thermally stressed fiber-reinforced composite materials N87-10933
The interaction between advection, radiation, turbulence, and microphysics in the formation of Arctic stratus clouds N87-11384
A mesoscale climate model for the investigation of atmospheric flows under the influence of orography, turbulence, and cloud physics N87-11410
Ice accretion dependence on cloud physical parameters N87-11433
The use of microcomputers for glider weather forecasting N87-11448
News about the visibility of signal lights under the influence of the atmosphere N87-11454
Model calculations of the thermally induced mesoscale mountain wind circulation N87-11456
DEUTSCHER WETTERDIENST, OFFENBACH AM MAIN (WEST GERMANY).
Reports of meteorology, no. 23: Proceedings of the German Meteorologists' Conference on the Global Climate and Our Environment [ISBN-3-88148-226-1] N87-11367
Long range atmospheric transport of anthropogenic aerosols in and through the Arctic N87-11370
Diagnostic investigations of the intertropical convergent zone N87-11372
Measurement, calculation, and parameterization of atmospheric heat radiation N87-11390
Cloud parameterization with a statistical method N87-11401
Model simulations of the coastal experiment PUKK N87-11407
Thermodynamic aspects of the absorption of gas in droplets N87-11421
Ice accretion calculations on cylindrical rods following the Bain model, and comparison with experimental results (Fuchs, Schickel, Kaluza, Uwira, 1985) N87-11434
Small scale and short term variability of global radiation in the Federal Republic of Germany N87-11440
Climatological data of the Federal Republic of Germany N87-11443
Increase of the dust mass content in the air of Hamburg (West Germany) N87-11450
Satellite measurements of the cloudiness and the global radiation for global statistics N87-11462
DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN (WEST GERMANY).
On optimal passive and active control of precision spacecraft structures N87-10891
Damping representation related to spacecraft structural design N87-10898
Analysis/test correlation and update of dynamic mathematical models N87-10913
Active microwave instrumentation Traveling Wave Tube (TWT) amplifiers: Electrical modes, phase 2 [AMI/2/18] N87-11115
Solid Earth satellite: Market, cost and benefits study [ESA-CR(P)-2213-VOL-1] N87-11636
High altitude research rocket program astronomy: Payload Inter-Zodiak. Report on system development, integration, testing, and flight [BMFT-FB-W-85-025] N87-11655
DOUGLAS AIRCRAFT CO., INC., LONG BEACH, CALIF.
Critical joints in large composite aircraft structure [NASA-CR-3710] N87-10973
DC-10 composite vertical stabilizer ground test program [NASA-CR-3715] N87-10974
Critical composite joint subcomponents: Analysis and test results [NASA-CR-3711] N87-10975
DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, S.C.
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data [DE86-008904] N87-11337

E

EAGLE-PICHER INDUSTRIES, INC., JOPLIN, MO.
An advanced Ni-Cd battery cell design N87-11087
The 4.5 inch diameter IPV Ni-H2 cell development program N87-11103
EAST ANGLIA UNIV., NORWICH (ENGLAND).
Data bases for isolating the effects of the increasing carbon dioxide concentration [DE86-009709] N87-11469
ECOLE NATIONALE SUPERIEURE DE PHYSIQUE, STRASBOURG (FRANCE).
Emissivity in the thermal infrared: Conditions for measurement by backscattering and comparison with a passive measurement method N87-11279
ECOLE NORMALE SUPERIEURE, PARIS (FRANCE).
Reflectance of strand sediments: Results of in situ measurements and a SPOT simulation in Mont Saint Michel bay N87-11283
EDGERTON, GERMESHAUSEN AND GRIER, INC., IDAHO FALLS, IDAHO.
Simulation of the preliminary General Electric SP-100 space reactor concept using the ATHENA computer code [DE86-005324] N87-11590
ELECTRICITE DE FRANCE, CHATOU.
Finite element methods for incompressible Navier-Stokes and for shallow water equations N87-11121
ELECTROCHEM INDUSTRIES, INC., CLARENCE, N.Y.
Safety considerations for fabricating lithium battery packs N87-11079
ENERGY SCIENCE LABS., INC., SAN DIEGO, CALIF.
Guidebook for analysis of tether applications [NASA-CR-178903] N87-10944
ENGELHARD CORP., EDISON, N.J.
Develop and test fuel cell powered on site integrated total energy systems. Phase 3: Full-scale power plant development [NASA-CR-175118] N87-11344
Develop and test fuel cell powered on-site integrated total energy systems. Phase 3: Full-scale power plant development [NASA-CR-175117] N87-11346
Develop and test fuel cell powered on site integrated total energy sysems: Phase 3: Full-scale power plant development [NASA-CR-175075] N87-11347

ENGINEERING SYSTEM INTERNATIONAL, RUNGIS (FRANCE).
Equivalent continuum analyses of large space trusses N87-10894
Numerical calculation of damage tolerance and admissable stress in components made of composite materials using the PAM-FISS/bi-phase material model N87-10936
ERNO RAUMFAHRTTECHNIK G.M.B.H., BREMEN (WEST GERMANY).
Study on a drop and bubble unit. Volume 1: Executive study
[ESA-CR(P)-2256] N87-10881
Initial results from multiaxes transient testing N87-10917
Evaluation of heater design concepts for hydrazine decomposition chambers
[ESA-CR(P)-2239] N87-10962
Composites design handbook for space structure applications. Executive summary
[ESA-CR(P)-2196] N87-10982
EUROPEAN SPACE AGENCY, PARIS (FRANCE).
Proceedings of an International Conference on Spacecraft Structures
[ESA-SP-238] N87-10886
Material selection for carbon fiber reinforced composite structures
[ESA-TT-950] N87-10965
Results of wind tunnel tests on external combustion
[ESA-TT-959] N87-10990
Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing
[ESA-SP-247] N87-11238
EUROPEAN SPACE AGENCY. EUROPEAN SPACE OPERATIONS CENTER, DARMSTADT (WEST GERMANY).
Operational evaluation of METEOSAT data N87-11455
EUROPEAN SPACE AGENCY. EUROPEAN SPACE RESEARCH AND TECHNOLOGY CENTER, ESTEC, NOORDWIJK (NETHERLANDS).
Design and verification activities and requirements for spacecraft structures N87-10890
ESA fracture control policy and fracture mechanics spectra for STS payloads N87-10893
An experimental campaign for the determination of radar structure of the ocean at C band N87-11239
Airborne and tower-based scatterometry during the PROMESS and TOSCANE-T campaigns N87-11240
Towards a C-band radar sea echo model for the ERS-1 scatterometer N87-11243
Digital combination of SAR and (MSS) optical data for identification of spectral signatures N87-11329

F

FEDERAL AVIATION ADMINISTRATION, ATLANTIC CITY, N.J.
An investigation of the FAA vertical Bunsen burner flammability test method
[DOT/FAA/CT-86/22] N87-10985
Avgas/autogas comparison: Winter fuels
[DOT/FAA-CT-86/21] N87-11014
FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D. C.
Land Mobile Radio/UHF Television Technical Advisory Committee final report in the matter of further sharing of the UHF television band by private land mobile radio services
[PB86-206562] N87-11070
FERMI NATIONAL ACCELERATOR LAB., BATAVIA, ILL.
Neutrinos from gravitational collapse
[DE86-012304] N87-11663
FLEMING (W. S.) AND ASSOCIATES, INC., SYRACUSE, N.Y.
Residential Earth-coupled heat pump demonstration
[PB86-212396] N87-11141
FLORIDA UNIV., GAINESVILLE.
Jupiter's decameter and kilometer emissions: Satellite effects and long term periodicities N87-11675
FOOTSCRAY INST. OF TECH. (AUSTRALIA).
On a simple vibration control design for large space structure models with uncertain parameters N87-10903
FORD AEROSPACE AND COMMUNICATIONS CORP., PALO ALTO, CALIF.
Energy storage systems comparison for the space station N87-11075
Nickel-hydrogen batteries from Intelsat 5 to space station N87-11101
FRAUNHOFER-INST. FUER ARBEITSWIRTSCHAFT UND ORGANISATION, STUTTGART (WEST GERMANY).
Evaluation study of the indirect-specific funding for the development of industrial robots, manipulation systems, and their intelligent periphery N87-11504
FRAUNHOFER-INST. FUER PRODUCTIONSTECHNIK UND AUTOMATISIERUNG, STUTTGART (WEST GERMANY).
Technical and organizational concepts of the application of Industrial Robots and Manipulation Systems (IR/HHS). Experiences of the Consultant Center for Industrial Robots (BZI) N87-11505
FRAUNHOFER-INST. FUER SYSTEMTECHNIK UND INNOVATIONSFORSCHUNG, KARLSRUHE (WEST GERMANY).
First results of the evaluation study of the indirect-specific funding of the operational utilization of CAD/CAM systems N87-11501
FREIBURG UNIV. (WEST GERMANY).
Investigation of spectral reflectance signatures on forest damages using multispectral data N87-11320
FREIE UNIV., BERLIN (WEST GERMANY).
The internal memory of open hydrodynamic systems N87-11414
A nonlinear theory of baroclinic instability N87-11418
Description of matter-radiation interactions as nonlinear irreversible processes N87-11420
A statistical method for prediction of pollutant emission N87-11428
The influence of weather-active fronts on visual flight conditions N87-11437

G

GARRETT CORP., PHOENIX, ARIZ.
Thermal barrier coating life prediction model development N87-11197
NASA dilution jet mixing, phase 3 N87-11202
GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
Data management: DoD should redirect its efforts to automate technical data depositories
[AD-A168095] N87-11629
GENERAL DYNAMICS CORP., FORT WORTH, TEX.
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 2
[NASA-CR-172494] N87-10859
Design and fabrication of the NASA decoupler pylon for the F-16 aircraft, addendum 1
[NASA-CR-172355] N87-10860
GENERAL ELECTRIC CO., FAIRFIELD, CONN.
Effects of surface chemistry on hot corrosion life N87-11193
Thermal barrier coating life prediction model development N87-11198
Burner liner thermal/structural load modelling N87-11205
The 3D inelastic analysis methods for hot section components N87-11206
Component specific modeling N87-11207
Constitutive modeling for isotropic materials N87-11212
Elevated temperature crack growth N87-11214
GENERAL MOTORS CORP., DETROIT, MICH.
Turbine airfoil gas side heat transfer N87-11219
GENERAL TECHNOLOGY SYSTEMS B.V., THE HAGUE (NETHERLANDS).
Economic study for NAVSAT
[GTS-84051] N87-11568
GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
Stochastic crack propagation with applications to durability and damage tolerance analyses
[AD-A168040] N87-11226
GEORGIA INST. OF TECH., ATLANTA.
Sound propagation over uneven ground and irregular topography
[NASA-CR-179827] N87-11575
GKSS-FORSCHUNGSZENTRUM GEESTHACHT (WEST GERMANY).
The finite element method for calculation of the calibration curves for fracture mechanics specimens of various thickness for the electrical direct current potential crack monitoring systems
[GKSS-86/E/3] N87-11230
Subgrid parameterization in flows with helicity N87-11382
A comparison of several models for the calculation of ground temperature and ground moisture N87-11389
Scale-dependent models for climatology N87-11396
The dynamic basic structure of the Geesthacht (West Germany) mesoscale model N87-11409
Test of a simple cloud model with precipitation N87-11452
GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS).
Large flexible space structures: Some simple models
[TW-269] N87-10957
Comparison of some partial differential equation models of flexible structures
[TW-270] N87-11559
GULF AND WESTERN APPLIED SCIENCE LABS., WALTHAM, MASS.
Research in the area of visual search
[AD-A168923] N87-11483

H

HAMBURG UNIV. (WEST GERMANY).
Climate-effective transport processes in the ocean N87-11360
A simple parameterization scheme for the determination of the relative coverage by cumulus clouds N87-11393
Interactive coupling of oceanic top layer models and atmospheric circulation models N87-11399
The effects of mountains on blocking in a circulation model. Consideration of the angular momentum balance N87-11400
Simulation of the cloud coverage in a climate model N87-11404
The response of the global atmosphere to the extraordinary El Nino sea surface temperature anomaly in January 1983: Simulation N87-11405
The response of the tropical atmosphere to the extraordinary El Nino sea surface temperature anomaly 1982-1983: Observation N87-11406
Possible fields of application of the wind tunnel for the solution of micrometeorological problems N87-11431
Dispersion of accidentally released heavy gases N87-11432
Verification of a cumulus-convection parameterization using data sets from tropical and medium latitudes N87-11441
Synoptic flow fields in front of the Norwegian west coast, measured with a high frequency radar N87-11445
HAMILTON STANDARD, WINDSOR LOCKS, CONN.
Effect of angular inflow on the vibratory response of a counter-rotating propeller
[NASA-CR-174819] N87-10840
HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH.
SP-100 ground engineering system at Hanford, volume 2
[DE86-009961] N87-11591
HELSINKI UNIV. OF TECHNOLOGY, ESPOO (FINLAND).
Microwave scattering loss of dry snow N87-11288
HONEYWELL POWER SOURCES CENTER, HORSHAM, PA.
Galileo Li/SO sub 2 battery modules program update N87-11076
HUGHES AIRCRAFT CO., LOS ANGELES, CALIF.
Environmentally-induced discharge transient coupling to spacecraft
[NASA-CR-174922] N87-10946
HUGHES AIRCRAFT CO., NEWPORT BEACH, CALIF.
Solar powered hybrid sensor module program
[NASA-CR-172495] N87-11343
HUMAN ENGINEERING LABS., ABERDEEN PROVING GROUND, MD.
Anthropometric considerations for a four-axis side-arm flight controller
[AD-A168135] N87-11487
HUNTING GEOLOGY AND GEOPHYSICS LTD., BOREHAM WOOD (ENGLAND).
An investigation of spectral signatures from mineralised rock outcrop as defined by airborne TM data of the Saudi Arabian shield N87-11311

I

IGI CONSULTING, INC., BOSTON, MASS.
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 1: Executive summary
[NASA-CR-179479] N87-11056
US long distance fiber optic networks: Technology, evolution and advanced concepts. Volume 2: Fiber optic technology and long distance networks
[NASA-CR-179480] N87-11057
ILLINOIS UNIV., URBANA.
A study of microstrip antennas for multiple band and high frequency operations
[AD-A169011] N87-11061
Real-time integration formulas with off-step inputs and their stability
[DE86-011852] N87-11516
ILLINOIS UNIV., URBANA-CHAMPAIGN.
EOS: A project to investigate the design and construction of real-time distributed embedded operating systems
[NASA-CR-179674] N87-11510
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
The solution of the parabolized Navier-Stokes equations
[CFD/86/2] N87-11130

INDIANA UNIV., BLOOMINGTON.
The interaction of a strong stellar wind with a multiphase interstellar medium N87-11667
INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, BREST (FRANCE).
The PROMESS 84 and TOSCANE-85 campaigns in-situ measurements N87-11241
Illustration of wind field time and space statistics during the TOSCANE-T campaign N87-11248
Sea wind fluctuations analysis N87-11249
Spectral signatures of coastal objects N87-11282
INSTITUT FRANCAIS DU PETROLE, RUEIL-MALMAISON.
SAR imaging of the sea surface during the ESA C-band wind scatterometer campaign N87-11247
Contribution of internal waves to spectral signatures N87-11331
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, AVIGNON (FRANCE).
Utilization of high spectral resolution to monitor the evolution of wheat crops N87-11278
Investigation of the complementarity of the middle infrared with the visible and near infrared spectra for vegetation monitoring N87-11310
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, PARIS (FRANCE).
Description of crop geometry, restricted to parts viewed N87-11273
INSTITUT NATIONAL DE RECHERCHE D'INFORMATIQUE ET D'AUTOMATIQUE, LE CHESNAY (FRANCE).
Finite element methods for the calculation of compressible viscous flows using self-adaptive mesh refinements N87-11122
INSTITUT NATIONAL DE RECHERCHE D'INFORMATIQUE ET D'AUTOMATIQUE, RENNES (FRANCE).
Characterization of the spectral, spatial and temporal signature of vineyards and orchards: Application to soil and crop remote sensing N87-11322
INSTITUTE FOR METEOROLOGY AND WATER ECONOMY, CRACOW (POLAND).
Evolution of sodar echoes as a climatological characteristic of the boundary layer N87-11459
INSTITUTE OF OCEAN SCIENCES, SIDNEY (BRITISH COLUMBIA).
Development of an imaging optical spectrometer for ocean and land remote sensing N87-11275
INSTITUUT VOOR CULTURRTECHNIEK EN WATERHUISHOUDING, WAGENINGEN (NETHERLANDS).
Travel report of a visit to the United States from 17 August to 31 August 1985
[ICW-1659] N87-11339
Remote sensing in hydrology
[ICW-1687] N87-11340
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE (ITALY).
Some aspects of wave-functions in disordered and incommensurate models
[DE85-703226] N87-11610
INTERNATIONAL METEOROLOGICAL INST., STOCKHOLM (SWEDEN).
Activities report in meteorology
[AR-84/85] N87-11473
INTESPACE, TOULOUSE (FRANCE).
Effective modal parameters and truncation effects in structural dynamics N87-10897
ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO. LTD., TOKYO (JAPAN).
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213984] N87-11005

J

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Spacecraft load, design and test philosophies N87-10922
Loads analysis for the Galileo spacecraft N87-10926
The Telecommunications and Data Acquisition Report
[NASA-CR-179715] N87-11024
DSS 13 frequency stability tests performed during May 1985 through March 1986 N87-11025
New short-time alignment technique for 70-meter antenna surface panels N87-11026
A prototype DSN X/S-band feed: Model 3 development N87-11027
Stability investigation of the quadripod structure for the NASA/JPL 70-meter antenna N87-11028
Array feed synthesis for correction of reflector distortion and Vernier Beamsteering N87-11029
The 1- to 4-K refrigeration techniques for cooling masers on a beam waveguide antenna N87-11030
Single longitudinal mode operation of semiconductor laser arrays with etalon control N87-11031
A recursive solution for a fading memory filter derived from Kalman filter theory N87-11032
An estimator-predictor approach to PLL loop filter design N87-11033
Choosing channel quantization levels and viterbi decoding for space diversity reception over the additive white Guassian noise channel N87-11034
Phase lock acquisition for sampled data PLLs using the sweep technique N87-11035
A method to dramatically improve subcarrier tracking N87-11036
A new method for frame synchronization N87-11037
Cramer-Rao bounds for signal-to-noise ratio and combiner weight estimation N87-11038
Antenna arraying of Voyager telemetry signals by symbol stream combining N87-11039
A VLSI architecture for performing finite field arithmetic with reduced table look-up N87-11040
A new VLSI complex integer multiplier which uses a quadratic-polynomial residue system with Fermat numbers N87-11041
Unattended deep space station tracking station development: Monitor and control technology N87-11042
A system for the functional testing and simulation of custom and semicustom VLSI chips N87-11043
Prototyping and implementing flight qualifiable semicustom CMOS P-well bulk integrated circuits in the JPL environment N87-11044
Ulysses: A functional description and simulation software system N87-11045
Improved performance of a digital phase-locked loop combined with a frequency/frequency-rate estimator N87-11046
VLA feedhorn for Voyager encounter of Neptune N87-11047
X-band preamplifier filter N87-11048
Physical optics analysis of a 4-reflector antenna, part 2 N87-11049
Finite wordlength implementation of a megachannel digital spectrum analyzer N87-11050
Deep space network Mark 4A description N87-11051
HEO multimission navigation concept N87-11052
ICE navigation support N87-11053
Objectives and first results of the NASA SETI sky survey field tests at Goldstone N87-11054
Demonstration of the fiducial concept using data from the March 1985 GPS field test N87-11055
Safety hazards associated with the charging of lithium/sulfur dioxide cells N87-11078
Heat dissipation of high rate Li-SOCl sub 2 primary cells N87-11080
Test results of JPL LiSOCl sub 2 cells N87-11081
Examination of design options for 35 Ah ambient temperature Li-TiS sub 2 cells N87-11083
Imaging spectrometry: Past, present, future N87-11274
Stress and efficiency studies in EFG
[NASA-CR-179814] N87-11618
JOHANN-WOLFGANG-GOETHE-UNIV., FRANKFURT AM MAIN (WEST GERMANY).
The statistical estimation of pure and equivalent CO2 signals in climatological time series N87-11369
The influence of volcanics on the ground level air temperature (1781-1984) N87-11371
Multivariate statistical investigations of the paleoclimatology of Central Europe N87-11375
Statistical analysis of secular temperature series N87-11376
Heating of the atmosphere by particle absorption short wavelength radiation N87-11391
A comparison between detailed and parameterized formulations of droplet/droplet coagulation mechanisms N87-11392
Solar radiation transport in realistic atmospheres with 3-dimensional cloud fields N87-11412
Evolution theorems for dissipative processes. General and meteorological aspects N87-11419
Numerical simulation of photosmog in a dynamic-kinetic model of the atmospheric boundary layer N87-11451
JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).
Analysis of multilevel measurements of spectral signatures for less-favored areas N87-11301
Ground level radiometric monitoring of rainy season food crops in the Sahel N87-11317

K

KAISERSLAUTERN UNIV. (WEST GERMANY).
On Knudsen flows within thin tubes
[PREPRINT-97] N87-11137
Diagonally implicit Runge-Kutta methods for parabolic equations in conservation law form
[PREPRINT-980] N87-11552
KANSAS UNIV., LAWRENCE.
An experimental investigation of dynamic ground effect N87-10833
KANSAS UNIV. CENTER FOR RESEARCH, INC., LAWRENCE.
Parametric analysis of a passive cyclic control device for helicopters
[NASA-CR-166606] N87-10862
KARLSRUHE UNIV. (WEST GERMANY).
The calculation of the flow resistance of orographic obstacles using a mesoscale model N87-11366
The significance of initialization for the unsteady simulation of mesoscale flows N87-11408
Canalization of the atmospheric flow through valleys N87-11446
Orographic influence on regional flow conditions, the example of the Neuwieder basin. Numerical simulations N87-11458
KASSEL UNIV. (WEST GERMANY).
Structural system identification using single and multiaxial vibration test data N87-10911
KENTRON INTERNATIONAL, INC., HAMPTON, VA.
Numerical methods and a computer program for subsonic and supersonic aerodynamic design and analysis of wings with attainable thrust considerations
[NASA-CR-3808] N87-10829
KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY).
Strain rate dependence of the deformation behavior of polymers at low temperatures
[KFK-4060] N87-11013
A theory of fractal fluids
[KFK-4070] N87-11134
On the numerical integration of viscoplastic models
[KFK-4082] N87-11135
Proceedings of a Specialized Symposium on the Evaluation of Design and Application of Modern Manufacturing Technologies
[KFK-PFT-119] N87-11500
Practical experience with the application of CAD/CAM to a medium-size company N87-11502
Nucleation in binary supersaturated gas mixtures
[KFK-4036] N87-11581
KIEL UNIV. (WEST GERMANY).
Vertical energy fluxes and meridional heat transport in the North Atlantic Ocean N87-11373
The ventilation of the warm water sphere in the north Atlantic Ocean N87-11423
The development of the subtropical mode-water, simulated using a surface layer integrated along a trajectory N87-11424
Determination of the circulation in the North Atlantic Ocean from climatological data N87-11425
The correlation between wind and the trajectories of satellite-positioned drift buoys N87-11426
Satellite observations of atmospherically determined changes of the ocean surface temperature N87-11427
Modeling of mesoscale processes at oceanic fronts N87-11439
Local optimal determination of the wind field on sea from wind and pressure observations using an inverse method N87-11444
Measurements in the ground level atmospheric layer during the experiment PUKK N87-11449
Analysis of mesoscale temperature and turbidity field N87-11457
KIRUNA GEOPHYSICAL INST. (SWEDEN).
A new way of organizing spectral line intensity ratio fluctuations of different elements
[KGI-PREPRINT-088] N87-10989
A new method of organizing spectral line intensity ratio fluctuations of nightglow emissions
[KGI-PREPRINT-087] N87-11361
A new method of organizing spectral line intensity ratio fluctuations of auroral emissions
[KGI-PREPRINT-089] N87-11362

L

LAWRENCE LIVERMORE NATIONAL LAB., CALIF.
Evolution of free-electron laser development
[DE86-008748] N87-11156
Development of precision turning capabilities at Lawrence Livermore National Laboratory
[DE86-011884] N87-11162
Design and performance of a small precision CNC turning machine
[DE86-008032] N87-11165
Design and use of zonally-averaged climate models
[DE86-008764] N87-11465

Challenge of detecting climate change induced by increasing carbon dioxide
[DE86-009704] N87-11467
Constructing a coherent long-term global total ozone climatology from the BUV, MFR, and SBUV/TOMS data sets
[DE86-009722] N87-11470
ARC-OLOGY via TELL-A-GRAF
[DE86-009698] N87-11517

LEAR SIEGLER, INC., GRAND RAPIDS, MICH.
Operating and support hazard analysis for self-contained navigation system LSI model 6216A, B and C, group B
[AD-A169361] N87-10855

LOCKHEED-GEORGIA CO., MARIETTA.
PTA test bed aircraft engine inlet model test report, revised
[NASA-CR-174845] N87-10666

LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
A space radiation test model study
[AD-A169412] N87-11681

LOGICA LTD., LONDON (ENGLAND).
Automated Information Retrieval System for Satellites (AIRS). Part 1, Chapter 2: Design phase
[REPT-71.4601] N87-11636

LOGISTICS MANAGEMENT INST., BETHESDA, MD.
Microcomputer-based local automation model: System planning guidance
[AD-A166136] N87-11630

LONDON UNIV. (ENGLAND).
The effect of the non-uniform stress distribution in the blankets of single and twin boom solar array panels upon their modal characteristics N87-10604

LOS ALAMOS NATIONAL LAB., N. MEX.
Single-pulse laser effects measurements at 248 nm
[DE86-011229] N87-11157
Machine learning using a higher order correlation network
[DE86-010183] N87-11537
Fiber optic, Faraday rotation current sensor
[DE86-012413] N87-11573
Resonance capture and Saturn's rings
[DE86-011733] N87-11674

M

MAINZ UNIV. (WEST GERMANY).
A two-dimensional numerical model for fog prognosis N87-11387
Numerical simulation of the urban climate using a 3-dimensional model N87-11411

MANAGEMENT AND TECHNICAL SERVICES CO., WASHINGTON, D.C.
USSR Space Life Sciences Digest, issue 8
[NASA-CR-3922(09)] N87-11478

MANDEX, INC., FALLS CHURCH, VA.
Study of fault-tolerant software technology
[NASA-CR-172385] N87-11507

MARBURG UNIV. (WEST GERMANY).
Turbulence theory from a present-day point of view N87-11415

MARCONI SPACE SYSTEMS LTD., PORTSMOUTH (ENGLAND).
Modern control of large flexible spacecraft, ESA ASTP study
[BL-8206-ISSUE-2] N87-10956

MARTIN MARIETTA AEROSPACE, DENVER, COLO.
Voltage-temperature charge verification testing of 34 ampere-hour nickel-cadmium cells N87-11092
Nickel-hydrogen low-Earth-orbit test program N87-11098
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation. Appendix A: ROBSIM user's guide
[NASA-CR-178051] N87-11536

MARTIN MARIETTA CORP., DENVER, COLO.
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix A
[NASA-CR-172402] N87-11534
Evaluation of automated decisionmaking methodologies and development of an integrated robotic system simulation, appendix B
[NASA-CR-172403] N87-11535

MARYLAND UNIV., COLLEGE PARK.
Machine learning using a higher order correlation network
[DE86-010183] N87-11537
Quantum effects in non-maximally symmetric spaces N87-11669

MASCHINENFABRIK AUGSBURG-NUERNBERG A.G., MUNICH (WEST GERMANY).
Grazing-incidence mirror carriers made of carbon fiber reinforced epoxy matrix system N87-10931

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Potential impacts of advanced technologies on the ATC capacity of high-density terminal areas
[NASA-CR-4024] N87-10854
Processing of laser formed SIC powder
[NASA-CR-179657] N87-11009
Effective conductivity of aging polyurethane foam
[DE86-008939] N87-11011
Spatial analysis of storm depths from an Arizona raingage network
[NASA-CR-177186] N87-11483
Signal processing and interpretation using multilevel signal abstractions
[AD-A169166] N87-11513
A methodology for designing robust multivariable nonlinear control systems
[NASA-CR-179691] N87-11567
Improvement in high magnetic field behavior of vanadium-gallium superconductors by enhancement of spin-orbit scattering
[DE86-007857] N87-11612

MASSACHUSETTS UNIV., AMHERST.
Relaxation properties of some segmented polyurethane-CaCO3 composites. A dielectric study
[AD-A169396] N87-10978
Model for prediction of the elastic response of composite materials over wide ranges of concentration
[AD-A169399] N87-10979
Data bases for isolating the effects of the increasing carbon dioxide concentration
[DE86-009709] N87-11469

MATRA ESPACE, TOULOUSE (FRANCE).
Electrostatic discharge effects on satellite electronic devices
[MATRA-CMT-138-JPG-078-85] N87-10953
High speed programmable processor for use on board satellites
[EPT/DI/006/GG/TT] N87-11497

MATRA SERVICE AERODYNAMIQUE, LE CHESNAY (FRANCE).
Structural development of the telescope structure of the HIPPARCOS satellite payload N87-10929

MAX-PLANCK-INST. FUER METEOROLOGIE, HAMBURG (WEST GERMANY).
Coupled ocean-atmosphere models without drift of the prognostic variables N87-11402
Numerical investigation of the nonlinear dynamics of boundary layer rolls N87-11417

MAX-PLANCK-INST. FUER PHYSIK UND ASTROPHYSIK, GARCHING (WEST GERMANY).
The current system generated by the PORCUPINE artificial ion beam in the ionospheric background plasma
[MPE-PREPRINT-49] N87-11355
Discovery of energetic molecular ions (NO+ and O2+) in the storm time ring current
[MPE-PREPRINT-53] N87-11356
Active plasma experiments
[MPE-PREPRINT-43] N87-11603
Adiabatic cooling of the artificial PORCUPINE plasma jet
[MPE-PREPRINT-46] N87-11604
Anomalous diffusion across the magnetic field-plasma boundary: The porcupine artificial plasma jet
[MPE-PREPRINT-47] N87-11605
Diamagnetic effect and anomalous transport in expanding plasma clouds
[MPE-PREPRINT-26] N87-11647
Data acquisition and evaluation electronics for the ROSAT Position Sensitive Proportional Counters (PSPC's)
[MPE-PREPRINT-33] N87-11648
The position sensitive proportional counter (PSPC) of the ROSAT telescope
[MPE-PREPRINT-32] N87-11649
Gamma ray astronomy from satellites and balloons
[MPE-PREPRINT-39] N87-11650
Torque and energy exchange between an accretion disk and a rapidly spinning neutron star
[MPE-PREPRINT-44] N87-11661
Bimodal quasi-oscillatory and spectral behavior in Sco X-1
[MPE-PREPRINT-45] N87-11662
X-ray bursts from GX 17+2: A new approach
[MPE-PREPRINT-48] N87-11678
Search for orbital X-ray variation in Sco X-1
[MPE-PREPRINT-51] N87-11679
Disappearance of periodic X-ray minima in AM Her
[MPE-PREPRINT-52] N87-11680

MAX-PLANCK-INSTITUT FUER STROEMUNGSFORSCHUNG, GOETTINGEN (WEST GERMANY).
Influence of shape on vortex shedding from two-dimensional cylinders at high Reynolds number and high subsonic Mach number
[MPIS-22/1985] N87-10844

MECHANICAL TECHNOLOGY, INC., LATHAM, N. Y.
Fatigue life of laser cut metals
[NASA-CR-179501] N87-11158

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., OTTOBRUNN (WEST GERMANY).
Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6) N87-10825
Analytical prediction of cylindrical and Cassini-shaped shell contours after plastic stretching N87-10939
Offset unfurlable antenna. Phase 2A: Executive summary
[MBB-R-0200/3069-R] N87-11066

MICHIGAN STATE UNIV., EAST LANSING.
Changes in the turbulent boundary layer structure associated with net drag reduction by outer layer manipulators N87-10850

MICHIGAN UNIV., ANN ARBOR.
Estimation of surface albedo and light absorption by atmospheric aerosols under clear skies from digitised GOES-east visual images N87-11366

MOBIL TYCO SOLAR ENERGY CORP., WALTHAM, MASS.
Stress and efficiency studies in EFG
[NASA-CR-179614] N87-11618

MOLI ENERGY LTD., BURNABY (BRITISH COLUMBIA).
A 65 Ah rechargeable lithium molybdenum disulfide battery N87-11082

MORGAN STATE UNIV., BALTIMORE, MD.
The calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects
[NASA-CR-179633] N87-11142

N

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Active Tectonics: Part 2: Epeirogenic and intraplate movements N87-11357

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.
Aeronautical facilities assessment
[NASA-RP-1146] N87-10876
NASA scanner produces complete image of North Atlantic Ocean
[NASA-NEWS-REL-86-147] N87-11335
Aeronautics and space report of the President N87-11683

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
Transonic flow analysis for rotors. Part 2: Three-dimensional, unsteady, full-potential calculation
[NASA-TP-2375] N87-10841
X-29A longitudinal and directional force and moment supplemental transonic wind tunnel test results
[NASA-TM-85909] N87-10861
Flight-determined aerodynamic derivatives of the AD-1 oblique-wing research airplane
[NASA-TP-2222] N87-10871
Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow
[NASA-TM-85948] N87-11143

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
The 1985 Goddard Space Flight Center Battery Workshop
[NASA-CP-2434] N87-11072
Qualification testing of general electric 50 Ah nickel-cadmium cells with new separator and new positive plate processing N87-11084
Modeling Ni-Cd performance. Planned alterations to the Goddard battery model N87-11089
Investigation of long term storage effects on aerospace nickel-cadmium cell performance N87-11090
NOAA 26.5 Ah LEO characterization test N87-11093
Recent advances in Ni-H2 technology at NASA Lewis Research Center N87-11095
Investigation of nickel hydrogen battery technology for the RADARSAT spacecraft N87-11097
Parametric tests of a 40-Ah bipolar nickel-hydrogen battery N87-11100
Modelisation of the optical scattering behaviour of the vegetation canopies N87-11264
The First International Satellite Land-Surface Climatology Project (ISLSCP) Field Experiment (FIFE) N87-11294
Preliminary results of a quantitative comparison of the spectral signatures of Landsat Thematic Mapper (TM) and Modular Optoelectronic Multispectral Scanner (MOMS). N87-11296

Microwave sensing of atmospheric water using the future AMSU system N87-11307

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Space shuttle payload design and development N87-10888

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

Effects of tail span and empennage arrangement on drag of a typical single-engine fighter aft end [NASA-TP-2352] N87-10838

Static internal performance of single-expansion-ramp nozzles with thrust-vectoring capability up to 60 deg [NASA-TP-2364] N87-10839

Piloted simulation study of the effects of an automated trim system on flight characteristics of a light twin-engine airplane with one engine inoperative [NASA-TP-2633] N87-10843

Ground-based time-guidance algorithm for control of airplanes in a time-metered air traffic control environment: A piloted simulation study [NASA-TP-2516] N87-10864

Proposed input for determining longitudinal aerodynamic parameters for the space shuttle [NASA-TM-85758] N87-10869

Interference effects of thrust reversing on horizontal tail effectiveness of twin-engine fighter aircraft at Mach numbers from 0.15 to 0.90 [NASA-TP-2350] N87-10870

Proceedings of the 2nd Annual SCOLE Workshop [NASA-TM-89048] N87-10945

The effects of space radiation on a chemically modified graphite-epoxy composite material [NASA-TM-89232] N87-10977

A new readily processable polyimide [NASA-TM-89253] N87-11008

Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive [NASA-TM-89045] N87-11010

Design and development of a multibeam 1.4 GHz pushbroom microwave radiometer [NASA-TM-89005] N87-11105

Finite length effects in Taylor-Couette flow [NASA-CR-178175] N87-11125

Some recent developments in spectral methods [NASA-CR-178178] N87-11127

Structural behavior of the space shuttle SRM Tang-Clevis joint [NASA-TM-89018] N87-11177

Airborne lidar measurements of El Chichon stratospheric aerosols, May 1983 [NASA-RP-1172] N87-11358

A survey of functional programming language principles [NASA-TM-89019] N87-11506

Multiprocessing the Sieve of Eratosthenes [NASA-CR-178131] N87-11509

Effects of backing plates on the electron exposure of thin polymer films [NASA-TM-88995] N87-11589

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Status of advanced propulsion for space based orbital transfer vehicle [NASA-TM-88848] N87-10959

Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit [NASA-TM-88865] N87-10960

NASA Lewis evaluation of Regenerative Fuel Cell (RFC) systems N87-11073

A flooded-starved design for nickel-cadmium cells N87-11086

Thermohydrodynamic analysis for laminar lubricating films [NASA-TM-88845] N87-11124

Turbine Engine Hot Section Technology, 1984 [NASA-CP-2339] N87-11180

Combustion overview N87-11181

Surface protection N87-11182

Fatigue and fracture: Overview N87-11183

Host turbine heat transfer overview N87-11184

Laser anemometers of hot-section applications N87-11187

Evaluation results of the 700 deg C Chinese strain gages N87-11189

Coating life prediction N87-11194

Introduction to life modeling of thermal barrier coatings N87-11195

Aerothermal modeling program, phase 2 N87-11200

Flame radiation N87-11204

High temperature stress-strain analysis N87-11209

Component testing of a ground based gas turbine steam cooled rich-burn primary zone combustor for emissions control of nitrogeneous fuels [NASA-TM-88873] N87-11345

An efficient method for solving the steady Euler equations [NASA-TM-87329] N87-11543

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Development of deployable truss concept for space station N87-10923

NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).

Unsteady airload computations for airfoils oscillating in attached and separated compressible flow [NLR-MP-85040-U] N87-10846

Correlation between flight simulation and processing of flight tests based on inertial measurements [NLR-MP-85058-U] N87-10863

Corrosion and corrosion prevention in aircraft structures [NLR-MP-85029-U] N87-11004

Regulations, criteria, and measurement practice for susceptibility criteria [NLR-MP-84089-U] N87-11065

Computer aided design of robot manipulators and their operations [NLR-MP-85012-U] N87-11172

Fatigue fracture in steel landing gear components [NLR-MP-85050-U] N87-11233

Simulation of multitemporal SAR images N87-11256

A scene radiation model based on four-stream radiative transfer theory N87-11262

Real time debugging software package for flight simulator software system with variable labeled COMMON blocks [NLR-MP-85013-U] N87-11530

NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD.

Journal of Research of the National Bureau of Standards, volume 91, number 1, January-February 1986 [PB86-206384] N87-11021

Automated measurement of frequency response of frequency-modulated generators using the Bessel null method [PB86-202991] N87-11150

NBS (National Bureau of Standards) 50 kHz phase angle calibration standard [PB86-201274] N87-11151

NATIONAL GEOPHYSICAL DATA CENTER, BOULDER, COLO.

Solar-geophysical data number 500, April 1986. Part 2: (Comprehensive reports). Data for October 1985 and miscellanea [PB86-213873] N87-11364

Solar-geophysical data number 500, April 1986. Part 1: (Prompt reports). Data for March 1986, February 1986 and late data [PB86-213865] N87-11365

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MICH.

Airborne measurements of the spectral reflectance of freshwater ice N87-11280

NATIONAL PHYSICAL LAB., TEDDINGTON (ENGLAND).

Analysis of laser frequency stability of heterodyne measurements [NPL-MOM-78] N87-11153

Measurements performed at the National Physical Laboratory for an international intercomparison of neutron fluence rate measurements for monoenergetic fast neutrons using the 115 sub In(n, gamma reaction [NPL-RS(EXT)-81] N87-11580

Concave diffraction gratings [NPL-MOM-77] N87-11592

NATIONAL SPACE DEVELOPMENT AGENCY, IBARAKI (JAPAN).

Structural concept of Japanese advanced geostationary spacecraft N87-10920

NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON, D. C.

National Transportation Safety Board safety recommendation N87-10852

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.

Propagation of signals in the frequency band between 30 MHz and 100 MHz [AD-A169332] N87-11063

NAVAL OCEANOGRAPHY COMMAND CENTER/JOINT TYPHOON WARNING CENTER, FPO SAN FRANCISCO, CALIF.

Tropical cyclone report, 1985 [AD-A168284] N87-11464

NAVAL RESEARCH LAB., WASHINGTON, D. C.

A collisional-radiative model and Saha decrements for a nonequilibrium oxygen plasma [AD-A168062] N87-11606

NAVAL SURFACE WEAPONS CENTER, SILVER SPRING, MD.

Determining the influence and effects of manufacturing variables on sulfur dioxide cells N87-11077

NAVAL WEAPONS SUPPORT CENTER, CRANE, IND.

Satellite battery testing status N87-11091

NEW YORK STATE UNIV., BINGHAMTON.

Estimation of canopy parameters for row-planted vegetation canopies from reflectance data through inversion of canopy reflectance data N87-11285

NEW YORK UNIV., NEW YORK.

The Martian climate and energy balance models with CO2/H2O atmospheres [NASA-CR-179886] N87-11573

NIPPON STEEL CORP., TOKYO (JAPAN).

Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests [PB86-213964] N87-11005

NORTH CAROLINA STATE UNIV., RALEIGH.

The crystallization of tough thermoplastic resins in the presence of carbon fibers [NASA-CR-179810] N87-11006

Chemical reaction in shock compression of solids [DE86-003502] N87-11611

NORTH CAROLINA UNIV., CHAPEL HILL.

UV observations of blue stragglers and population 2 K dwarfs [NASA-CR-179885] N87-11653

NORTHWESTERN UNIV., EVANSTON, ILL.

Parallel processors and nonlinear structural dynamics algorithms and software [NASA-CR-179889] N87-11511

NOTRE DAME UNIV., IND.

The temporal development of a low-speed two-dimensional jet in a viscous cross-flow N87-10848

NOTTINGHAM UNIV. (ENGLAND).

The physical and physiological interpretation of vegetation spectral signatures N87-11272

Estimation of atmospheric corrections from multiple aircraft imagery N87-11306

O

OAK RIDGE NATIONAL LAB., TENN.

Protection of spacecraft from meteoroids and orbital debris [DE86-009996] N87-10947

Whisker-reinforced ceramic composites [DE86-011058] N87-10980

Strain contrast in SiC whisker reinforced Al sub 2 O sub 3 [DE86-009537] N87-10981

Relationship of an alloy's mechanical properties to its response to individual erosive particle impacts [DE86-011778] N87-11000

Analysis of loop current step response data obtained from in situ tests of temperature detectors [DE86-011750] N87-11147

Documentation of materials data for computer storage and retrieval [DE86-009509] N87-11493

CESAR research in intelligent machines [DE86-008226] N87-11494

Advances in concurrent computers for autonomous robots [DE86-008236] N87-11538

OESTERREICHISCHES FORSCHUNGSZENTRUM SEIBERSDORF G.M.B.H., VIENNA.

The dynamics of heat transfer in turbulent pipe flow, part 3 [OEFZS-4351] N87-11133

Identification of creep mechanisms and quantitative description of stress regimes relevant to design [OEFZS-4352] N87-11232

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).

La Recherche Aerospatiale, bimonthly bulletin, number 1985-4, 227/July-August [ESA-TT-960] N87-11019

Direct numerical simulation of homogeneous strained turbulence N87-11120

La Recherche Aerospatiale, bimonthly bulletin, number 1985-5, 228/September-October [ESA-TT-964] N87-11131

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, TOULOUSE (FRANCE).

Design improvement and radiation, contamination tests. Prestudy 1: Ultraviolet radiation acceleration, volume 1 [CERT-4193-VOL-1] N87-10949

Design improvement and radiation contamination tests. Prestudy 1: Ultraviolet radiation acceleration. Volume 2: Appendix, detailed results
[CERT-4193-VOL-2] N87-10950

Improving the irradiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 1: Tests and conclusions
[CERT-4193-VOL-3] N87-10951

Improving radiation plus contamination tests. Prestudy 2: Successive irradiations and synergics. Volume 2: Annexes. Annex 1: Detailed results. Annex 2: Control and improvement of optical measurements
[CERT-4193-VOL-4] N87-10952

Improving radiation/contamination tests
[CERT-419300/1-DERTS] N87-10954

OFFICE OF NAVAL RESEARCH, LONDON (ENGLAND).

European Science Notes, volume 40, number 7
[AD-A168089] N87-11645

OHIO STATE UNIV., COLUMBUS.

Extension of the Ritz method to the forced, damped vibrations of rotating structural elements N87-11234

OKLAHOMA STATE UNIV., STILLWATER.

Lateral jet injection into typical combustor flowfields N87-11203

OLD DOMINION UNIV., NORFOLK, VA.

Graduate engineering research participation in aeronautics
[NASA-CR-179798] N87-10828

A review of time domain modal test methods and applications N87-10915

Conduction investigations into the magnetic properties of matter
[NASA-CR-179868] N87-11126

Passive damping concepts for slender columns in space structures
[NASA-CR-179807] N87-11178

Computational solution of atmospheric chemistry problems
[NASA-CR-179803] N87-11353

OLDENBURG UNIV. (WEST GERMANY).

Laser remote sensing of the marine environment: Recent results obtained with the oceanographic lidar system N87-11284

OPEN UNIV., MILTON (ENGLAND).

Age-dependent changes in the spectral response of lava surfaces due to weathering, growth of lichen and spread of vascular plants N87-11327

OREGON STATE UNIV., CORVALLIS.

Challenge of detecting climate change induced by increasing carbon dioxide
[DE86-009704] N87-11467

OSAKA GAS CO. LTD. (JAPAN).

Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005

OSNABRUECK UNIV. (WEST GERMANY).

The carbon exchange between atmosphere and terrestrial biosphere N87-11385

P

PACIFIC NORTHWEST LABS., RICHLAND, WASH.

Development of an expert systems computer program for control panel design enhancement
[DE86-012153] N87-11489

Experiences with a data analysis management prototype
[DE86-011615] N87-11626

PARAGON PACIFIC, INC., EL SEGUNDO, CALIF.

WEST-3 wind turbine simulator development. Volume 1: Summary
[NASA-CR-174981] N87-11348

PARIS-SUD UNIV., ORSAY (FRANCE).

Study of a discharge produced by a standing surface wave
[LP-213] N87-11609

PARIS VI UNIV. (FRANCE).

Evaluation of SPOT for mapping sedimentary and volcanic rocks N87-11312

Spectral signatures and mapping of mineral deposits of south Morocco N87-11323

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.

Study of plasma convection and wall interactions in magnetic confinement systems
[DE86-011919] N87-11607

PHYSICS LAB. RVO-TNO, THE HAGUE (NETHERLANDS).

Analysis of the ESA wind scatterometer campaign data N87-11251

PLESSEY RESEARCH (CASWELL) LTD., TOWCESTER (ENGLAND).

Sub-millimetre (far-IR) heterodyne spectrometer assembly
[CD.8500689] N87-10958

POLITECNICO DI MILANO (ITALY).

A proposal for a new software reliability model and its preliminary assessment
[REPT-86-001] N87-11519

A multivariable self-tuning controller with integral action
[REPT-86-002] N87-11539

Translation and optimization of logic queries: The algebraic approach
[REPT-86-004] N87-11631

POPE (L. D.), WOODLANDS, TEX.

Propeller aircraft interior noise model utilization study and validation
[NASA-CR-172428] N87-11576

PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN.

Further development of the dynamic gas temperature measurement system N87-11185

Development of heat flux sensors in turbine airfoils N87-11186

Demonstration test of burner liner strain measurements using resistance strain gages N87-11190

Thermal barrier coating life prediction model development N87-11199

The 3-D inelastic analysis methods for hot section components (base program) N87-11208

Creep fatigue life prediction for engine hot section materials (isotropic): Two year update N87-11213

Life prediction and constitutive models for engine hot section anisotropic materials N87-11218

Coolant passage heat transfer with rotation, a progress report N87-11225

PRINCETON UNIV., N. J.

Analysis of the dispersion force between a layered sphere and a cylinder
[AD-A169444] N87-11621

Photometric redshifts and cosmology N87-11658

Q

QUALITY ASSURANCE DIRECTORATE (MATERIALS), LONDON (ENGLAND).

A survey of recent developments in X-ray diffractometry
[MQAD-TR-910] N87-10983

Corrosion by polyurethane antistatic foams
[MQAD-R-343] N87-10984

QUEBEC UNIV., CHICOUTIMI.

Anemothermographic remote sensing using airborne sensors: A new method of micrometeorological cartography N87-11291

R

RADIO TECHNICAL COMMISSION FOR AERONAUTICS, WASHINGTON, D. C.

Minimum operational performance standards for airborne ILS glide slope receiving equipment operating within the radio frequency range of 328.6-335.4 MHz
[RTCA/DO-192] N87-10853

RCA ASTRO-ELECTRONICS DIV., PRINCETON, N. J.

Impact of shuttle environment on prelaunch handling of nickel-hydrogen batteries N87-11099

READING UNIV. (ENGLAND).

Spectral signatures of land cover types in the Sahel for geobotanical modeling N87-11325

RENAULT VEHICLES INDUSTRIELS (FRANCE).

Applications of basic research to diesel combustion optimization
[ETN-86-98411] N87-10991

RENSSELAER POLYTECHNIC INST., TROY, N.Y.

Comparison of the effects of alloyed molybdenum and aqueous molybdate on the pitting resistance of iron-chromium alloys
[DE86-011918] N87-10997

RESEARCH CENTER GRAZ (AUSTRIA).

Spectral analysis of a heavy metal-stressed forest canopy using Landsat TM data N87-11309

RESEARCH INST. OF NATIONAL DEFENCE, LINKOEPING (SWEDEN).

Microwaves and microelectronics
[FOA-C-30426-E] N87-11118

Snow studies: Study journey to Switzerland, January 1986
[FOA-C-30419-E1,E3] N87-11341

An infrared searchlight
[FOA-C-30421-E4] N87-11602

RICE UNIV., HOUSTON, TEX.

Computer simulation of the dynamics of the near-earth part of the geomagnetic tail
[AD-A169449] N87-11359

RIJKSWATERSTAAT, THE HAGUE (NETHERLANDS).

An atmospheric correction method using Guzzi-spectroradiometer input data N87-11305

ROCKWELL INTERNATIONAL CORP., LOS ANGELES, CALIF.

Supersonic second order analysis and optimization program user's manual
[NASA-CR-172342] N87-10842

ROLLS-ROYCE LTD., DERBY (ENGLAND).

Future aero-engine control systems, why FADEC? Cost, design cycle timescale, reliability, weight and size targets
[PNR-90298] N87-10867

Engine performance monitoring for airlines
[PNR-90305] N87-10868

The growth of fatigue cracks in a nickel base single crystal
[PNR-90310] N87-11001

Net shape forming: The route to low cost components. The view point of the aerospace industry
[PNR-90306] N87-11020

A summary of DO-178A
[PNR-90294] N87-11518

Aircraft noise measurement: The 1.2 metre microphone height saga
[PNR-90315] N87-11578

Cost effective single crystals
[PNR-90319] N87-11615

Development of single crystal alloys for specific engine applications
[PNR-90320] N87-11616

Engineers: Can they be managed?
[PNR-90307] N87-11627

ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.

Printed circuit transmission line transitions
[AD-A169291] N87-11110

Microstrip amplitude-weighted wilkinson power dividers
[AD-A169450] N87-11111

Comparison of modal to nodal approaches for wavefront correction
[AD-A168088] N87-11597

ROME UNIV. (ITALY).

Computational methods in elastic periodic structures analyses N87-10901

The Array Processor with Emulator (APE) project: A computer for lattice QCD
[NOTA-INTERNA-839] N87-11495

Equivalent classes of integrable nonlinear evolution equations and generalized Miura Transformations
[PREPRINT-497] N87-11546

Multifractal wave function at the localization threshold
[PREPRINT-499] N87-11547

Transition to stochasticity in Hamiltonian systems: Some numerical results
[PREPRINT-503] N87-11548

Scaling law and asymptotic distribution of Lyapunov exponents in conservative dynamical systems with many degrees of freedom
[NOTA-INTERNA-859] N87-11564

Physics and event simulation at HERA with H1 (report of the Working Group of the H1 Collaboration for HERA)
[NOTA-INTERNA-854] N87-11582

The external muon detector for ICARUS
[NOTA-INTERNA-863] N87-11583

The discovery of the positron
[PREPRINT-469] N87-11584

Light gluinos at the CERN ppbar collector
[PREPRINT-470] N87-11585

Electroweak interactions
[PREPRINT-482] N87-11586

Molecular dynamics simulation of rigid molecules
[PREPRINT-494] N87-11587

Hyperphotons and K meson decays
[PREPRINT-498] N87-11588

Langevin equations With negative diffusion coefficients. A new approach to quantum optics
[NOTA-INTERNA-862] N87-11589

Effective Landau theory for disordered interacting electron systems: Specific heat behavior
[PREPRINT-500] N87-11617

An alternative proof of ultraviolet stability of the two-dimensional massive sine Gordon field theory in all regions of collapse
[NOTA-INTERNA-855] N87-11623

An alternative model for the density of states in the Quantum Hall Effect
[NOTA-INTERNA-858] N87-11624

Probabilistic solutions of generalized birth and death equations and application to nonrelativistic electrodynamics
[PREPRINT-483] N87-11625

On the radiation emitted by a particle falling into a black hole in the semirelativistic approximation
[NOTA-INTERNA-857] N87-11664

Scaling violation in hadronic interactions and the deep underground flux of cosmic muons
[PREPRINT-495] N87-11682

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
Non-destructive methods of characterising the strength of adhesive-bonded joints
[RAE-TM-MAT/STR-1065] N87-11176
ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
Heat exchangeable liquid injected compressors
[ETN-86-97852] N87-11166
ROYAL NETHERLANDS AIRCRAFT FACTORIES FOKKER, AMSTERDAM.
Reliability and economics of spacecraft structure development N87-10921
Engineering and software interfacing for thermal, structural and attitude control related with spacecraft N87-10928
ROYAL NETHERLANDS METEOROLOGICAL INST., DE BILT.
Some considerations of wave propagation
[KNMI-WR-86-2(GO)] N87-11069
Dry deposition parameterization in long range transport models
[KNMI-WR-86-1] N87-11354
MEPRO: A volume of IMIS procedures for the use of the operational-meteorological practice
[REPT-84-2] N87-11474
A simple guidance forecast for 100 stations in Europe as a support for the weather report for holiday countries
[REPT-84-4] N87-11475
The IMIS program NESO
[REPT-84-1] N87-11521
ROYAL SIGNALS AND RADAR ESTABLISHMENT, MALVERN (ENGLAND).
Spectral analysis for radar using linear predictive filtering
[RSRE-MEMO-3896] N87-11022
Experiments on the annotation of large quantities of speech using the ZIP dynamic time-warping algorithm
[RSRE-MEMO-3919] N87-11023
Silicon wafer cleaning for integrated circuit fabrication
[RSRE-MEMO-3907] N87-11071
The use of values without names in a programming support environment
[RSRE-MEMO-3901] N87-11498
Orwellian programming in safety-critical systems
[RSRE-MEMO-3924] N87-11499

S

SAAB-SCANIA, LINKOPING (SWEDEN).
Tele-X antenna module structure qualification program N87-10824
SANDIA NATIONAL LABS., ALBUQUERQUE, N. MEX.
Global positioning system missile test range applications
[DE86-011994] N87-10856
Physical metallurgy issues in solder joint performance
[DE86-010961] N87-10999
Fractal aspects of ceramic synthesis
[DE86-011657] N87-11012
Current problems in solid dynamics
[DE86-011653] N87-11229
FY 1984 and FY 1985 geochemistry and materials studies in support of the Magma Energy Extraction Program
[DE86-009558] N87-11338
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351
Minor scale weather-watch and microbarograph project experiments 8620, 9415, 9416
[DE86-009641] N87-11466
Chemical reaction in shock compression of solids
[DE86-003502] N87-11611
SCIENTIFIC RESEARCH ASSOCIATES, INC., GLASTONBURY, CONN.
Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations N87-11220
SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
Calibration of GOES-5 and GOES-6 VISSR/VAS short-wavelength channels N87-11295
Downward long-wave irradiance at the ocean surface using satellite data N87-11303
Long-term climate change in observed physical properties of the oceans
[DE86-009706] N87-11468
SHEFFIELD UNIV. (ENGLAND).
Image based visual servo control of a revolute-coordinate (arm and elbow) robot
[RR-288] N87-11169
Characterising vegetated surfaces with airborne MSS data N87-11315
SHERBROOKE UNIV. (QUEBEC).
Variation of atmospheric effects on measured radiance as a function of imaging altitude N87-11304
SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Combined ultraviolet studies of astronomical sources
[NASA-CR-179784] N87-11651
SOCIETE BERTIN ET CIE, PLAISIR (FRANCE).
Dynamics of flexible mechanisms N87-10938
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, CANNES (FRANCE).
Truss structure with great dimensional stability: Principle of design, development, certification N87-10892
Space technologies and materials: A look back and future perspectives N87-10934
Advanced ocean color monitor (OCM) feasibility study, executive summary
[SNIAS-86-CA/LL/O] N87-11477
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, LES MUREAUX (FRANCE).
Prediction of the high frequency response of satellites to diffuse acoustic environments N87-10906
Development of a lightened structure for the GSR3 solar generator N87-10927
Investigation of the coupling of the Hermes vehicle to the Ariane 5 launcher N87-10937
Kinematic analysis of a large deployable truss antenna N87-10941
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, SAINT-MEDARD-EN-JALLES (FRANCE).
A method of studying the behavior of composite materials in simulated space environments N87-10940
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, TOULOUSE (FRANCE).
Efficiency of various control surfaces in steady and unsteady flow
[SNIAS-861-111-101] N87-10872
SOFTWARE AND ENGINEERING ASSOCIATES, INC., SANTA ANA HEIGHTS, CALIF.
Improved two-dimensional-kinetics computer program
[NASA-CR-179782] N87-11508
SOUTH CAROLINA UNIV., COLUMBIA.
Feasibility study of wood stork foraging habitat mapping using LANDSAT multispectral data
[DE86-008904] N87-11337
SOUTHAMPTON UNIV. (ENGLAND).
Acoustic radiation and internal dissipation in honeycomb panels N87-10909
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Constitutive modeling for isotropic materials N87-11211
SOZIOLOGISCHES FORSCHUNGSINST. E.V., GOETTINGEN (WEST GERMANY).
Manufacturing planning in machine building from the point of view of management and workshop personnel N87-11503
SPAR AEROSPACE LTD., STE-ANNE-DE-BELLEVUE (QUEBEC).
Demonstration of modal synthesis on an experimental structure and its application to large spacecraft N87-10912
SPIRE CORP., BEDFORD, MASS.
Investigation of high-efficiency silicon concentrator cells
[DE86-011914] N87-11350
STANDARD ELEKTRIK LORENZ A.G., STUTTGART (WEST GERMANY).
GRANAS: Global Radio Navigation System
[BMFT-FB-W-85-034] N87-10857
Development and test of a miniaturized fiber-optic gyroscope
[BMFT-FB-W-85-033] N87-11148
STANFORD LINEAR ACCELERATOR CENTER, CALIF.
Superstrings and geometry of superspace
[DE86-012044] N87-11622
STANFORD UNIV., CALIF.
Computation of transonic separated wing flows using an Euler/Navier Stokes zonal approach N87-10849
Control of a free-flying robot manipulator system
[NASA-CR-179877] N87-11159
Effects of very high turbulence on convective heat transfer N87-11222
An algorithm for rescaling a matrix positive definite
[AD-A169257] N87-11569
Separation of airborne and structureborne noise radiated by plates constructed of conventional and composite materials with applications for prediction of interior noise paths in propeller driven aircraft N87-11579
An atlas of photospheric magnetic field observations and computed coronal magnetic fields, 1976-1985
[AD-A168046] N87-11677
STOCKHOLM UNIV. (SWEDEN).
A comparison between Landsat-Thematic Mapper (TM) data and ground measured radiance and soil data N87-11300
Spectral measurements for estimation of biomass on limestone grassland N87-11319
Reflectance properties of conifers, measured from a helicopter N87-11321
Reflectance properties of barley for different agronomical treatments N87-11326
Laboratory measurements of spectral reflectance (0.4 to 2.3 micron) of basalts N87-11332
Electron transport in integral photoemission X-ray standing wave analysis
[USIP-86-03] N87-11614
STUTTGART UNIV. (WEST GERMANY).
Analysis of directional coupler signals in an overmoded waveguide system
[IPF-86-2] N87-11067
Components for transmission of very high power mm waves (200 kW at 28, 70 and 140 GHz) in overmoded circular waveguides
[IPF-86-2] N87-11068
Determination of the mass concentration of the particles in aerosols using the sound velocity measurement
[FR-235/20-1] N87-11574
Activities report of the Institute for Plasma Research
[ETN-86-98253] N87-11608
SUMITOMO METAL INDUSTRIES, LTD., OSAKA (JAPAN).
Crack arrest properties of 9 percent nickel steel and relation between crack-initiation and crack-arrest tests
[PB86-213964] N87-11005
SVERDRUP TECHNOLOGY, INC., ARNOLD AIR FORCE STATION, TENN.
Large perturbation flow field analysis and simulation for supersonic inlets
[NASA-CR-174876] N87-10835
SYRACUSE UNIV., N. Y.
Electromagnetic field-to-wire coupling in the SHF/EHF frequency range
[AD-A168083] N87-11059
Oxidation and low cycle fatigue life prediction N87-11215
SYSTAN, FRAENKISCH-CRUMBACH (WEST GERMANY).
Support for the design and the implementation of the spacecraft performance evaluation services
[ESOC/85/1] N87-11632

T

TECHNISCHE HOCHSCHULE, AACHEN (WEST GERMANY).
Transient external loads or interface forces reconstructed from structural response measurements N87-10910
Application of the finite element method to the thermomechanical analysis of direct-fiber-preform forging: Possibilities and examples
[ETN-86-97826] N87-11170
TECHNISCHE HOCHSCHULE, DARMSTADT (WEST GERMANY).
Time series analysis and composite analysis of equatorial observations from ships N87-11377
Conclusions from the migration of Barchans on the dominating wind conditions in desert regions N87-11413
Change of the local climate by deforestation. A numerical simulation experiment N87-11447
TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Wind tunnel experiments on the diffuser characteristics of a tip vane turbine
[IW-R511] N87-10845
About the development of interactive shell design codes N87-10889
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard
[ESA-CR(P)-2249] N87-11116
Some calculations based on a mathematical model for fluid flow through a collapsible tube
[REPT-85-41] N87-11138
The scaling of two phase flow
[MEAH-64] N87-11139
On robots with flexible links: Dynamics, control and stability
[REPT-85-34] N87-11171
Analysis and calibration of the Dutch scatterometer measurements N87-11246
On actions due to lack of information
[REPT-85-45] N87-11486
On Karmarkar's projective method for linear programming
[REPT-85-23] N87-11527
Computer aided education in the choice of studies
[REPT-85-29] N87-11528
Techniques for reducing Boolean evaluation time in Constructive Solid Geometry (CSG) scan-line algorithms
[REPT-85-43] N87-11529

A note on waiting times in systems with queues in parallel
[REPT-85-46] N87-11540
Reduction and reconstruction of control knowledge in rule based systems. Part 1: Reduction theory
[REPT-85-50] N87-11541
Pairwise-comparison methods using fuzzy numbers on ratio scales with geometric progression
[REPT-85-24] N87-11553
The structure of orbits in dynamical systems (revised version)
[REPT-85-28] N87-11554
An iterative solution method for solving f(A)x=b, using cg-information obtained for the symmetric positive definite matrix A
[REPT-85-32] N87-11555
A convergence proof of a multigrid method
[REPT-85-39] N87-11556
Multiple objective modeling: Experimental results with interactive methods in the Netherlands
[REPT-85-49] N87-11557
On numerical dispersion by upwind differencing
[REPT-85-51] N87-11558
Multivariate calibration: A generalization of the classical estimator
[REPT-85-31] N87-11565
On restrictions of projections along separable metric spaces
[REPT-85-42] N87-11571
The interface with decision makers and some experimental results in interactive multiple objective programming methods
[REPT-85-36] N87-11628
CONST: A constructive approach to information modeling
[REPT-85-44] N87-11637

TECHNISCHE HOGESCHOOL, EINDHOVEN (NETHERLANDS).
The prediction of tool pressures in coining
[WPB-0132] N87-11173

TECHNISCHE HOGESCHOOL TWENTE, ENSCHEDE (NETHERLANDS).
Implementation of windmills in Gujarat, India
[ETN-86-97720] N87-11342
TUMULT: A distributed real-time multi-processor system
[INF-85-3] N87-11496
Abstract grammars based on transductions
[INF-85-13] N87-11522
Software tools for the design of protocol systems, part 1
[INF-85-21] N87-11523
Design and implementation of the TUBA application generation system
[INF-85-23] N87-11524
Introduction to the Tools for User-Friendly Business Applications (TUBA) system
[INF-85-24] N87-11526
A survey of the Twente University MULTIprocessor (TUMULT) system, a real time multiprocessor system
[INF-85-22] N87-11533
A note on prime terms
[INF-85-5] N87-11550
On local and nonlocal measures of efficiency
[ISSN-0169-2690] N87-11566
A family of Fibonacci-like sequences
[INF-85-10] N87-11570
Making a simple relational database system
[INF-84-16] N87-11633
Minimizing the response time of a query in a distributed data base
[INF-85-26] N87-11634
A modeling approach to information system development
[INF-85-29] N87-11635

TECHNISCHE PHYSISCHE DIENST TNO-TH, DELFT (NETHERLANDS).
Design, definition, and manufacture participation for the SAR Electronic Power Converter (EPC) breadboard
[ESA-CR(P)-2249] N87-11116

TECHNISCHE UNIV., BERLIN (WEST GERMANY).
Phenomenology of the evolution of large-scale boundary layer structures N87-11416

TECHNISCHE UNIV., HANOVER (WEST GERMANY).
Atmospheric processes at the boundary of the Antarctic continent N87-11395
Numerical simulation of the turbulent diffusion above a rough terrain N87-11430
The influence of the planetary boundary layer on the vertical structure of the horizontal sight up to a height of 300 m N87-11435
Hydrological behavior pattern of isolated lakes and their role in paleoclimatology N87-11438
Boundary layer investigations and aerological measurements at the Antarctic research station Georg von Neumayer N87-11442
Development of vortex rolls in case of cold air outbreaks above the sea. A numerical study N87-11453
Statistics of wind shear due to nocturnal boundary layer jet airstreams in North Germany N87-11461

TECHNISCHE UNIV., MUNICH (WEST GERMANY).
The CO2 laser imaging spectroscopy for Earth observation N87-11285
Calibration of Modular Optoelectronic Multispectral Scanner Charged Couple Device (MOMS-CCD) data and qualitative test using Thematic Mapper (TM) data N87-11296
Climate models with stochastic excitation N87-11398
The energy balances of selected types of surface in the Munich urban area N87-11429

TEL-AVIV UNIV. (ISRAEL).
Reflectivity contrast of forested slopes with snow-covered ground N87-11271

TENNESSEE UNIV. SPACE INST., TULLAHOMA.
Gas flow environmental and heat transfer nonrotating 3D program N87-11223

TEXAS A&M UNIV., COLLEGE STATION.
Performance analysis of a cascaded coding scheme with interleaved outer code
[NASA-CR-179866] N87-11512

TEXAS INSTRUMENTS, INC., DALLAS.
The 20 GHz GaAs monolithic power amplifier module development
[NASA-CR-179830] N87-11104

TEXAS UNIV., ARLINGTON.
Backscatter measurements from simulated vegetation structures N87-11254
Spaceborne SAR depolarisation ambiguities N87-11260
Scattering models for coniferous and deciduous vegetation N87-11263

TEXAS UNIV., AUSTIN.
A study of nodal coupling methods N87-10896
The effect of a row of Helmholtz resonators on the turbulence in a boundary layer
[NASA-CR-179832] N87-11123
Molecular clouds associated with young open star clusters N87-11859
Vacuum polarization on black hole spacetimes N87-11668

TOKYO UNIV. (JAPAN).
Measurements of microwave backscatter from trees N87-11318

TOULOUSE UNIV. (FRANCE).
Electromechanical study contributing to the formulation of an analog evolutionary model representing nickel-cadmium batteries
[REPT-JMH/GB/GR/769-84] N87-11117
Airborne measurement methods applied to the determination of boundary conditions at the sea surface: The TOSCANE experiment N87-11242
Dynamics of the marine boundary layer. Determination of boundary conditions N87-11244
Analysis of airborne measurements of the marine boundary layer during the TOSCANE experiment N87-11250

U

UMPQUA RESEARCH CO., MYRTLE CREEK, ORE.
A prototype space flight intravenous injection system
[NASA-CR-171911] N87-11481

UNITED TECHNOLOGIES CORP., EAST HARTFORD, CONN.
Hot section viewing system
[NASA-CR-174773] N87-11144

UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
High temperature static strain gage program N87-11188
Mass and momentum turbulent transport experiments N87-11201
Measurement of airfoil heat transfer coefficients on a turbine stage N87-11221
Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine N87-11224

UNIVERSITAET DER BUNDESWEHR, NEUBIBERG (WEST GERMANY).
A method for the fast estimation of the behavior of stochastic dynamic systems
[ETN-86-97823] N87-11549

UNIVERSITE CATHOLIQUE DE LOUVAIN (BELGIUM).
A translation property in rough surface scattering N87-11258

UNIVERSITE DE BRETAGNE OCCIDENTALE, BREST (FRANCE).
AVHRR data processing for utilization in dynamical oceanography N87-11302

UNIVERSITE DES SCIENCES ET TECHNIQUES DE LILLE (FRANCE).
Atmospheric effects in remote sensing: A program to simulate satellite signals in the solar spectrum N87-11293
Model of the solar radiation reflected by Earth and the atmosphere between 0.35 and 4 microns
[ESA-CR(P)-2254] N87-11363

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Research Issues in Power Conditioning: A workshop held at Los Angeles, California on 3-4 December 1985
[AD-A169268] N87-11082

UTAH UNIV., SALT LAKE CITY.
Follow-on proposal identifying environmental features for land management decisions
[NASA-CR-179703] N87-11236
Distribution, lithology and ages of late Cenozoic volcanism on the eastern margin of the Great Basin, West-Central Utah
[DE86-009888] N87-11360

UTRECHT STATE UNIV. (NETHERLANDS).
High temperature oxidation of alloys. Oxidation mechanisms and experimental methods
[ETN-86-96071] N87-11002

V

VALENCIA UNIV. (SPAIN).
Following the microclimatic alterations produced by forest fires by means of Landsat-5 TM sensor N87-11324
Landsat-5 TM application to the study of modification of spectral signatures of citric orchards affected by frosts N87-11334

VANDERBILT UNIV., NASHVILLE, TENN.
Toughness and matching extension in graphs
[AD-A169177] N87-11544

VARIAN ASSOCIATES, PALO ALTO, CALIF.
Fabricating high-concentration GaAs cell photovoltaic modules
[DE86-011705] N87-11351

VIGYAN RESEARCH ASSOCIATES, INC., HAMPTON, VA.
Stress analysis of Pathfinder-2 models
[NASA-CR-172458] N87-11179

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Energy management of 3-dimensional minimum-time intercept N87-10858
Critical element concepts for composite structures N87-10930
ANISAP: A three-dimensional finite element program for laminated composites subjected to mechanical loading
[NASA-CR-179867] N87-10976
An experimental investigation of the interior noise control effects of propeller synchrophasing
[NASA-CR-178185] N87-11577

VIRGINIA UNIV., CHARLOTTESVILLE.
Metal ion-promoted syntheses of boranes and carboranes
[AD-A169189] N87-10987
Numerical algorithms for finite element computations on concurrent processors
[NASA-CR-179822] N87-11542
A study of the applicability of nucleation theory to quasi-thermodynamic transitions of second and higher Ehrenfest-order, supplement 3
[NASA-CR-179836] N87-11619

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).
Computational Fluid Dynamics, volume 2
[VKI-LS-1986-04-VOL-2] N87-11119

W

WAGENINGEN AGRICULTURAL UNIV. (NETHERLANDS).
Experiments on modeling radar backscatter of forest stands and research on classification N87-11259
Multispectral aerial photography yielding well-calibrated reflectance factors with high spectral, spatial and temporal resolution for crop monitoring N87-11297

WASHINGTON STATE UNIV., PULLMAN.
Stability of UV optical coatings in hostile excimer laser environments
[AD-A169406] N87-11155

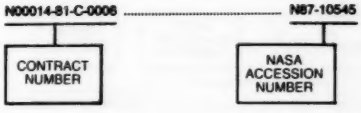
WASHINGTON UNIV., SEATTLE.
Design of control laws for adaptive signal tracking systems N87-10882
Effects of long-term radiofrequency radiation on immunological competence and metabolism
[AD-A169064] N87-11479

WESTFAELISCHE WILHELMS UNIV., MUENSTER (WEST GERMANY).
Climate models: Their application in the investigation of trace gases and the impact on climate N87-11397
Simulation of the effect of atmospheric trace gases on the global average temperature distribution N87-11403
WISCONSIN UNIV., MADISON.
High resolution spectroscopy of RS CVn stars N87-11657
WORLD CLIMATE PROGRAMME, GENEVA (SWITZERLAND).
Report of the COSPAR International Workshop on Satellite-Derived Sea Surface Temperatures for Global Climate Applications [WCP-110] N87-11471
Report of the Workshop on Global Large-Scale Precipitation Data Sets for the World Climate Research Programme [WCP-111] N87-11472

Y

YALE UNIV., NEW HAVEN, CONN.
Turbine airfoil deposition models N87-11191
Gaussian elimination on hypercubes [AD-A169293] N87-11514
A fast algorithm for particle simulations [AD-A169294] N87-11515
Data communication in parallel architectures [AD-A169302] N87-11531

Typical Contract Number Index Listing

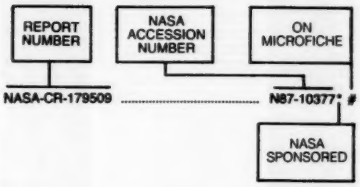


Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF-AFOSR-0044-86 ..... N87-11062
AF-AFOSR-0327-84 ..... N87-11543
BMFT-RV14B7/74 ..... N87-11355
N87-11604
BMFT-01-D0074A N87-11355
BMFT-01D0074A N87-11604
CNRC-OSU83-0094) N87-11304
DA PROJ. 1L1-61102-AH-45 ..... N87-11158
DA PROJ. 2Q1-61102-B-74-F N87-11488
DAAG29-81-K-0150 ..... N87-11227
DAAG29-82-K-0170 ..... N87-11620
DAAG29-83-C-0014 ..... N87-11483
DAAG29-83-K-0030 ..... N87-10987
DAAG29-85-M-0166 ..... N87-11572
DE-AA03-76SF00326 ..... N87-11569
DE-AC02-76CH-00016 ..... N87-11015
N87-11480
N87-11613
DE-AC02-76CH-03000 ..... N87-11683
DE-AC02-76ER-02383 ..... N87-11516
DE-AC02-76ET-53018 ..... N87-11607
DE-AC03-76SF-00098 ..... N87-10964
N87-10988
N87-11112
DE-AC03-76SF-00515 ..... N87-11622
DE-AC04-76DP-00789 ..... N87-10856
N87-10999
N87-11012
N87-11229
N87-11338
N87-11350
N87-11351
N87-11466
N87-11611
DE-AC05-84OR-21400 ..... N87-10947
N87-10980
N87-10981
N87-10998
N87-11000
N87-11011
N87-11147
N87-11493
N87-11494
N87-11538
DE-AC06-76FF-02170 ..... N87-11591
DE-AC06-76RL-01830 ..... N87-11489
N87-11628
DE-AC07-76ID-01570 ..... N87-11590
DE-AC07-79ID-12079 ..... N87-11360
DE-AC09-76SR-00001 ..... N87-11337
DE-AI01-76ET-20320 ..... N87-11348
DE-AI01-82CS-50286 ..... N87-11163
DE-AS03-76ER-72018 ..... N87-11569
DE-AS05-82ER-52089 ..... N87-10998
DE-FG02-84ER-45094 ..... N87-11612
DE-FG02-84ER-45101 ..... N87-10997
DEN3-241 ..... N87-11344
N87-11346
N87-11347
DEN3-247 ..... N87-11348
DFG-HE-1243/1,2 ..... N87-11419
DRET-SDR-G8 ..... N87-10936
DRET-83-403 ..... N87-11122
DRET-84-014 ..... N87-11122
ESA-4393/80-F-DD(SC) N87-11363
ESA-4548/80-NL-HP N87-10958
ESA-4657 ..... N87-11116
ESA-4751/81-F-DD-(SC) N87-10955
ESA-4960/81-NL-HP(SC) N87-11497
ESA-4999/82-F-DD(SC) N87-11117
ESA-5076/82-NL-PP N87-11115
ESA-5194/82-NL-PB(SC) N87-10961
ESA-5234/82-F-CF(SE) N87-11477
ESA-5234/82-F-FC(SC) N87-10880
ESA-5503/83-F-FC(SC) N87-10881
ESA-5864/83-NL-BI N87-10956
ESA-5756/83-F-FC(SC) N87-11638
N87-11639
ESA-5777/83-NL-MS N87-11256
ESA-5868/84-D-IM(SC) N87-11632
ESA-5968/84 ..... N87-11016
ESA-5990/84-NL-PP(SC) N87-10885
ESA-6022/84-F-RD(SC) N87-11568
ESA-6064/84-NL-PB N87-11352
ESTEC-1-1553/83-NL-BI N87-10953
ESTEC-3807/78-NL-AK N87-10962
ESTEC-5158/82-NL-PB(SC) N87-10928
ESTEC-5206/82-NL-PB(SC) N87-11066
ESTEC-5209/82-NL-PB(SC) N87-10894
ESTEC-5352/83-NL-HP(SC) N87-10956
ESTEC-5731/83-NL-BI N87-11636
ESTEC-5781/83-NL-AB N87-10949
N87-10950
N87-10951
N87-10952
N87-10954
ESTEC-5816/84-NL-PB(SC) N87-10982
ESTEC-6071/84-NL-BI(SC) N87-11654
F04701-85-C-0086 ..... N87-11060
F09603-85-C-1224 ..... N87-10855
F19628-82-K-0005 ..... N87-11061
F19628-83-K-0016 ..... N87-11359
F19628-85-C-0073 ..... N87-11681
F30602-81-C-0169 ..... N87-11059
F30602-81-C-0206 ..... N87-11596
F33615-83-C-0620 ..... N87-11479
F33615-83-K-3226 ..... N87-11226
GRI-5083-260-0676 ..... N87-10992
JPL-956312 ..... N87-11618
MDA903-85-C-0139 ..... N87-11630
MDA903-85-K-0225 ..... N87-11488
MIPR-ARO-117-86 ..... N87-11062
NAGW-95 ..... N87-11236
NAGW-104 ..... N87-11670
N87-11671
NAGW-200 ..... N87-11672
NAGW-573 ..... N87-11673
NAGW-788 ..... N87-11237
NAG1-46 ..... N87-11542
NAG1-237 ..... N87-11007
NAG1-336 ..... N87-11178
NAG1-343 ..... N87-10976
N87-10977
NAG1-390 ..... N87-11577
NAG1-419 ..... N87-11619
NAG1-431 ..... N87-10972
NAG1-472 ..... N87-10854
NAG1-525 ..... N87-11006
NAG1-566 ..... N87-11575
NAG1-610 ..... N87-11123
NAG1-650 ..... N87-11511
NAG2-297 ..... N87-11567
NAG3-201 ..... N87-11191
NAG3-312 ..... N87-11009
NAG3-379 ..... N87-11210
NAG5-87 ..... N87-11651
NAG5-388 ..... N87-11463
NAG5-424 ..... N87-11653
NAG5-778 ..... N87-11512
NASA ORDER H-78750B N87-11676
NASW-3676 ..... N87-11478
NAS1-14869 ..... N87-10974
NAS1-15820 ..... N87-10842
NAS1-16000 ..... N87-10829
NAS1-16087 ..... N87-10684
NAS1-16114 ..... N87-11179
NAS1-16205 ..... N87-10836
N87-10837
NAS1-16759 ..... N87-11534
N87-11535
N87-11536
NAS1-16857 ..... N87-10973
N87-10975
NAS1-16879 ..... N87-10859
N87-10860
NAS1-17070 ..... N87-11125
N87-11127
NAS1-17179 ..... N87-11343
NAS1-17281 ..... N87-11576
NAS1-17412 ..... N87-11507
NAS1-17993 ..... N87-11126
NAS1-18107 ..... N87-11125
N87-11127
N87-11509
NAS3-22771 ..... N87-11201
NAS3-23156 ..... N87-11144
NAS3-23278 ..... N87-11223
NAS3-23288 ..... N87-11213
NAS3-23293 ..... N87-11192
NAS3-23682 ..... N87-10835
NAS3-23695 ..... N87-11219
N87-11220
NAS3-23716 ..... N87-11224
NAS3-23781 ..... N87-11104
NAS3-23869 ..... N87-10946
NAS3-23926 ..... N87-11193
NAS3-23942 ..... N87-11158
NAS3-24222 ..... N87-10840
NAS3-24339 ..... N87-10866
NAS3-24682 ..... N87-11056
N87-11057
NAS5-24441 ..... N87-11680
NAS5-27577 ..... N87-11336
NAS7-100 ..... N87-11618
NAS7-918 ..... N87-11024
NAS8-35499 ..... N87-10944
NAS8-35931 ..... N87-11508
NAS9-16337 ..... N87-11481
NAS10-11165 ..... N87-10883
NATO-1865 ..... N87-11587
NB84RAC45137 ..... N87-11161
NCC2-175 ..... N87-10862
NCC2-333 ..... N87-11159
NCC3-27 ..... N87-11196
NGR-47-003-052 ..... N87-10828
NSF ATM-84-20781 ..... N87-11483
NSF DMS-84-20623 ..... N87-11569
NSF ECS-83-12142 ..... N87-11569
NSF ECS-84-07285 ..... N87-11513
NSG-1393 ..... N87-11353
NSG-1614 ..... N87-11569
NSG-2347 ..... N87-11652
NSG1-1471 ..... N87-11510
N00014-76-C-0207 ..... N87-11677
N00014-80-C-0798 ..... N87-11155
N00014-81-K-0742 ..... N87-11513
N00014-82-K-0184 ..... N87-11514
N87-11515
N87-11531
N00014-85-C-0893 ..... N87-11108
N00014-85-G-0251 ..... N87-11161
N00014-85-K-0343 ..... N87-11569
N00014-85-K-0488 ..... N87-11544
N00014-85-K-0860 ..... N87-10978
N00014-86-F-0049 ..... N87-11364
N87-11365
N00014-86-K-0085 ..... N87-11677
N00014-86-K-0860 ..... N87-10979
SERC-GR3/5096 ..... N87-11315
W-31-109-ENG-38 ..... N87-11532
N87-11598
W-7405-ENG-36 ..... N87-11156
N87-11157
N87-11164
N87-11537
N87-11573
N87-11674

W-7405-ENG-48 ..... N87-11162
N87-11165
N87-11465
N87-11467
N87-11468
N87-11469
N87-11470
N87-11517
W-7405-ENG-82 ..... N87-11228
481-50-32 ..... N87-10960
505-31-51 ..... N87-11143
505-31-53 ..... N87-11179
505-31-83-01 ..... N87-11509
505-33-43-07 ..... N87-10859
N87-10860
505-34-03-06 ..... N87-10869
505-40-90-01 ..... N87-10838
505-42-11 ..... N87-10841
N87-10862
505-43-13-01 ..... N87-10836
N87-10837
505-43-23-10 ..... N87-10829
505-43-42 ..... N87-10835
505-43-44 ..... N87-10871
505-43-90-07 ..... N87-10839
505-43-97-07 ..... N87-10870
505-45-33-02 ..... N87-10854
505-61-41-01 ..... N87-10843
505-62-0K N87-11158
505-62-21 ..... N87-11543
505-63-81 ..... N87-11124
505-65-11-02 ..... N87-11506
505-90-21-01 ..... N87-11127
506-41-41-01 ..... N87-11072
506-42-21 ..... N87-10959
506-43-11-01 ..... N87-11010
506-43-41-04 ..... N87-11177
506-44-21-03 ..... N87-11105
506-45-21-01 ..... N87-11536
506-46-11-01 ..... N87-10945
506-51-13-06 ..... N87-10884
506-53-23-01 ..... N87-11589
506-55-72 ..... N87-10948
533-02-81 ..... N87-10861
533-04-1A N87-11144
N87-11180
534-04-13-52 ..... N87-10864
535-03-11-03 ..... N87-11577
535-03-12 ..... N87-10866
672-21-14-70 ..... N87-11358

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-9682 ..... N87-10841* #
A-9723 ..... N87-11143* #

ACEE-26-TR-3074 ..... N87-10975* #

AD-A168040 ..... N87-11226 #
AD-A168041 ..... N87-11128 #
AD-A168042 ..... N87-11595 #
AD-A168046 ..... N87-11677 #
AD-A168076 ..... N87-11482 #
AD-A168082 ..... N87-11606 #
AD-A168083 ..... N87-11059 #
AD-A168084 ..... N87-11596 #
AD-A168088 ..... N87-11597 #
AD-A168089 ..... N87-11645 #
AD-A168095 ..... N87-11629 #
AD-A168124 ..... N87-10830 #
AD-A168135 ..... N87-11487 #
AD-A168136 ..... N87-11630 #
AD-A168138 ..... N87-10986 #
AD-A168147 ..... N87-11644 #
AD-A168161 ..... N87-11060 #
AD-A168168 ..... N87-11108 #
AD-A168185 ..... N87-11146 #
AD-A168186 ..... N87-11160 #
AD-A168284 ..... N87-11484 #
AD-A168923 ..... N87-11483 #
AD-A168939 ..... N87-11129 #
AD-A169011 ..... N87-11061 #
AD-A169018 ..... N87-11349 #
AD-A169024 ..... N87-11018 #
AD-A169064 ..... N87-11479 #
AD-A169166 ..... N87-11513 #
AD-A169174 ..... N87-11620 #
AD-A169175 ..... N87-11572 #
AD-A169176 ..... N87-11227 #
AD-A169177 ..... N87-11544 #
AD-A169189 ..... N87-10987 #
AD-A169198 ..... N87-10865 #
AD-A169257 ..... N87-11569 #
AD-A169259 ..... N87-11492 #
AD-A169261 ..... N87-11486 #
AD-A169268 ..... N87-11062 #
AD-A169281 ..... N87-11161 #
AD-A169284 ..... N87-10877 #
AD-A169291 ..... N87-11110 #
AD-A169293 ..... N87-11514 #
AD-A169294 ..... N87-11515 #
AD-A169302 ..... N87-11531 #
AD-A169332 ..... N87-11063 #
AD-A169346 ..... N87-11476 #
AD-A169381 ..... N87-10855 #
AD-A169398 ..... N87-10978 #
AD-A169399 ..... N87-10979 #
AD-A169406 ..... N87-11155 #
AD-A169412 ..... N87-11681 #
AD-A169444 ..... N87-11621 #
AD-A169449 ..... N87-11359 #
AD-A169450 ..... N87-11111 #

AD-D012259 ..... N87-11583 #
AD-D012260 ..... N87-11145 #
AD-D012263 ..... N87-11058 #
AD-D012264 ..... N87-11106 #
AD-D012265 ..... N87-11154 #
AD-D012266 ..... N87-11107 #
AD-D012313 ..... N87-11594 #
AD-D012353 ..... N87-11109 #

AD-E801301 ..... N87-11128 #
AD-E950834 ..... N87-11595 #

AFATL-TR-86-21 ..... N87-11128 #

AFGL-TR-86-0063 ..... N87-11359 #
AFGL-TR-86-0064 ..... N87-11681 #

AFHRL-TR-85-38 ..... N87-10865 #

AFWAL-TR-85-3062 ..... N87-11226 #

AIAA-86-1079 ..... N87-11543* #

AMA-84-10 ..... N87-10884* #

AMI/2/18 ..... N87-11115 #

AMSMI/RD-RE-86-1-TR ..... N87-11595 #

ANL/TM-438 ..... N87-11532 #

AR-7 ..... N87-11163 #
AR-84/85 ..... N87-11473 #

ARI-RN-86-67 ..... N87-11488 #

ARO-18358.4-MS ..... N87-11227 #
ARO-18867.7-PH ..... N87-11620 #
ARO-19953.9-CH ..... N87-10987 #
ARO-20540.2-LS ..... N87-11483 #
ARO-22553.1-MA-CF ..... N87-11572 #
ARO-23483.1-PH-CF ..... N87-11062 #

ASP-08 ..... N87-11647
ASP-49 ..... N87-11603
ASP-55 ..... N87-11356

AWI-CR-85-002 ..... N87-11161 #

BAE-AERO-INFORM-33 ..... N87-10832

BAE-ARG-204 ..... N87-10874

BAE-AXM127 ..... N87-10873

BAE-BT-12300 ..... N87-11600 #
BAE-BT-12489-VOL-1 ..... N87-11490 #
BAE-BT-12489-VOL-2 ..... N87-11491 #
BAE-BT-13481 ..... N87-10832
BAE-BT-13535 ..... N87-11484 #
BAE-BT-13621 ..... N87-11520 #
BAE-BT-13744 ..... N87-11132 #
BAE-BT-13801 ..... N87-11113 #
BAE-BT-13988 ..... N87-11601 #
BAE-BT-14107 ..... N87-11167 #
BAE-BT-14222 ..... N87-11485 #
BAE-BT-14500 ..... N87-11114 #
BAE-BT-14978 ..... N87-11166 #

BAE-B59R/R-D/610/13496 ..... N87-10875

BAE-S85/AMR/0066 ..... N87-10994

BAE-TP-8071 ..... N87-11352 #
BAE-TP-8207 ..... N87-10685 #

BL-6206-ISSUE-2 ..... N87-10956 #

BLL-CE-TRANS-8212-(9022.09) N87-10993

BMFT-FB-W-85-025 ..... N87-11655 #
BMFT-FB-W-85-033 ..... N87-11148 #
BMFT-FB-W-85-034 ..... N87-10857 #
BMFT-FB-W-85-035 ..... N87-10948 #

BNL-37962 ..... N87-11613 #
BNL-38057 ..... N87-11015 #

BO-RP-AI-004 ..... N87-11016 #

BRL-MR-3511 ..... N87-10986 #

BRL-TR-2722 ..... N87-11160 #
BRL-TR-2726 ..... N87-11146 #

BR95123 ..... N87-10984 #
BR98185 ..... N87-10963 #
BR98350 ..... N87-11176 #
BR98723 ..... N87-11498
BR98724 ..... N87-11071
BR98874 ..... N87-11022
BR99100 ..... N87-11499
BR99177 ..... N87-11023

BTI-0003 ..... N87-11108 #

B6664363 ..... N87-11065 #
B6664377 ..... N87-11559 #
B6664807 ..... N87-11064 #
B6666169 ..... N87-10957 #
B6666192 ..... N87-11069 #
B6666193 ..... N87-11354 #
B6667020 ..... N87-10863 #
B6667023 ..... N87-11172 #
B6667024 ..... N87-11530 #
B6667275 ..... N87-11004 #
B6667663 ..... N87-11551 #
B6667664 ..... N87-11562 #
B6667665 ..... N87-11583 #
B6667667 ..... N87-11561 #
B6667668 ..... N87-11560 #
B6667669 ..... N87-11140 #
B6667670 ..... N87-10847 #
B6668292 ..... N87-10846 #
B6668293 ..... N87-11233 #

CAB-160 ..... N87-10995 #

CCMS-86-03 ..... N87-10976* #
CCMS-86-06 ..... N87-10977* #

CD.6500689 ..... N87-10958 #

CERN-PREPRINT-TH.4326/85 ..... N87-11586 #

CERT-4193-VOL-1 ..... N87-10949 #
CERT-4193-VOL-2 ..... N87-10950 #
CERT-4193-VOL-3 ..... N87-10951 #
CERT-4193-VOL-4 ..... N87-10952 #
CERT-419300/PR1/T01-DERTS ..... N87-10949 #
CERT-419300/PR2/T01-DERTS ..... N87-10951 #
CERT-419300/1-DERTS ..... N87-10954 #

CFD/86/2 ..... N87-11130 #

CNES-CS/MM/82/117/CT/GRGS ..... N87-10955 #

CONF-860102-5 ..... N87-11590 #
CONF-860104-1 ..... N87-11000 #
CONF-860117-9 ..... N87-11156 #
CONF-860175-1 ..... N87-11622 #
CONF-860285-1 ..... N87-11466 #
CONF-860316-9 ..... N87-11598 #
CONF-860363-3 ..... N87-11517 #
CONF-860413-3 ..... N87-10980 #
CONF-860445-14 ..... N87-11012 #
CONF-860591-1 ..... N87-11485 #
CONF-860616-8 ..... N87-11611 #
CONF-860658-1 ..... N87-11489 #
CONF-860703-2 ..... N87-11573 #
CONF-860722-11 ..... N87-11493 #
CONF-860804-9 ..... N87-10988 #
CONF-860829-19 ..... N87-10981 #
CONF-860839-1 ..... N87-11165 #
CONF-860841-1 ..... N87-11494 #
CONF-860841-2 ..... N87-11538 #
CONF-860961-1 ..... N87-11162 #
CONF-861139-1 ..... N87-11157 #

CONF-8603101-2 N87-11337 #
CONF-8603103-2 N87-11626 #
CONF-8603112-1 N87-11613 #
CONF-8604116-3 N87-11112 #
CONF-8604178-2 N87-10964 #
CONF-8605102-1 N87-11470 #
CONF-8605106-1 N87-11537 #
CONF-8605141-1 N87-11228 #
CONF-8606123-1 N87-10999 #
CONF-8606137-1 N87-11229 #

COO-2383-0123 N87-11516 #

CRDEC-CR-86036 N87-11621 #

CRREL-SR-86-6 N87-11476 #

CWI-CS-R8606 N87-11064 #

CWI-NM-R8601 N87-10847 #
CWI-NM-R8602 N87-11140 #
CWI-NM-R8603 N87-11560 #
CWI-NM-R8604 N87-11561 #
CWI-NM-R8606 N87-11551 #
CWI-NM-R8607 N87-11562 #
CWI-NM-R8608 N87-11563 #

DERAT-6/5019-DN N87-10834 #

DE85-703226 N87-11610 #
DE86-003502 N87-11611 #
DE86-005324 N87-11590 #
DE86-007490 N87-10988 #
DE86-007857 N87-11612 #
DE86-008032 N87-11165 #
DE86-008226 N87-11494 #
DE86-008236 N87-11538 #
DE86-008703 N87-11480 #
DE86-008748 N87-11156 #
DE86-008764 N87-11465 #
DE86-008904 N87-11337 #
DE86-008939 N87-11011 #
DE86-009509 N87-11493 #
DE86-009537 N87-10981 #
DE86-009558 N87-11336 #
DE86-009641 N87-11466 #
DE86-009665 N87-11532 #
DE86-009696 N87-11517 #
DE86-009704 N87-11467 #
DE86-009706 N87-11468 #
DE86-009709 N87-11469 #
DE86-009722 N87-11470 #
DE86-009898 N87-11360 #
DE86-009937 N87-11646 #
DE86-009945 N87-11613 #
DE86-009961 N87-11591 #
DE86-009996 N87-10947 #
DE86-010183 N87-11537 #
DE86-010663 N87-11163 #
DE86-010961 N87-10999 #
DE86-011058 N87-10980 #
DE86-011229 N87-11157 #
DE86-011404 N87-11226 #
DE86-011534 N87-11015 #
DE86-011557 N87-10964 #
DE86-011563 N87-11112 #
DE86-011615 N87-11626 #
DE86-011653 N87-11229 #
DE86-011657 N87-11012 #
DE86-011705 N87-11351 #
DE86-011733 N87-11674 #
DE86-011748 N87-10996 #
DE86-011750 N87-11147 #
DE86-011759 N87-11164 #
DE86-011778 N87-11000 #
DE86-011852 N87-11516 #
DE86-011884 N87-11162 #
DE86-011914 N87-11350 #
DE86-011918 N87-10997 #
DE86-011919 N87-11607 #
DE86-011967 N87-10998 #
DE86-011994 N87-10656 #
DE86-012044 N87-11622 #
DE86-012129 N87-11596 #
DE86-012138 N87-11618* #
DE86-012153 N87-11489 #
DE86-012304 N87-11663 #
DE86-012413 N87-11573 #

DFVLR-FB-85-35 N87-10990 #
DFVLR-FB-86-10 N87-11136 #
DFVLR-FB-86-16 N87-11003 #
DFVLR-FB-86-17 N87-11017 #
DFVLR-FB-86-23 N87-10879 #

DFVLR-IB-22-85-A-29 N87-10961 #

DFVLR-MITT-85-09 N87-10965 #
DFVLR-MITT-85-07 N87-11525 #
DFVLR-MITT-85-10 N87-11149 #
DFVLR-MITT-85-11 N87-10878 #

DOD-4120.15-L N87-10831 #

DOE/CE-0027/4 N87-11163 #

DOE/ER-0191-3 N87-11646 #
DOE/ER-0243 N87-11480 #
DOE/ER-45094/3 N87-11612 #
DOE/ER-45101/1 N87-10997 #
DOE/ER-52089/T1 N87-10998 #

DOE/ET-53018/13 N87-11607 #

DOE/ID-12079/131 N87-11360 #

DOE/JPL-956312/14 N87-11618* #

DOE/NASA-0241-21 N87-11344* #
DOE/NASA-0241/19 N87-11347* #
DOE/NASA-0241/20 N87-11346* #
DOE/NASA-0247/1-VOL-1 N87-11348* #

DOE/NASA/-13111/16 N87-11345* #

DOMESTIC-CLASS-B1E-1143-1180 N87-10983

DOMESTIC-CLASS-C2C20Y304-30Y N87-10983

DOMESTIC-CLASS-U1S-2420-B1E- N87-10983

DOT/FAA-CT-86/21 N87-11014 #

DOT/FAA/CT-86/22 N87-10985 #

DP-MS-85-119 N87-11337 #

DP-7266 N87-10973* #
DP-7269 N87-10974* #

DTIC-TR-86/13 N87-11630 #

DTIC/TR-86/15 N87-11492 #

E-2267 N87-11180* #
E-3051 N87-11543* #
E-3235 N87-11124* #
E-3238 N87-10959* #
E-3268 N87-10960* #
E-3280 N87-11345* #

EGG-M-28185 N87-11590 #

EPT/DI/006/GG/TT N87-11497 #

ESA-CR(P)-2196 N87-10982 #
ESA-CR(P)-2197 N87-10956 #
ESA-CR(P)-2198 N87-10958 #
ESA-CR(P)-2199 N87-11086 #
ESA-CR(P)-2201 N87-11352 #
ESA-CR(P)-2206 N87-11497 #
ESA-CR(P)-2208 N87-11654 #
ESA-CR(P)-2210 N87-11632 #
ESA-CR(P)-2212 N87-11636 #
ESA-CR(P)-2213-VOL-1 N87-11638 #
ESA-CR(P)-2213-VOL-2 N87-11639 #
ESA-CR(P)-2218 N87-10885 #
ESA-CR(P)-2219 N87-10880 #
ESA-CR(P)-2220 N87-11016 #
ESA-CR(P)-2227-VOL-1 N87-10949 #
ESA-CR(P)-2227-VOL-2 N87-10950 #
ESA-CR(P)-2227-VOL-3 N87-10951 #
ESA-CR(P)-2227-VOL-4 N87-10952 #
ESA-CR(P)-2228 N87-11115 #
ESA-CR(P)-2229 N87-10953 #
ESA-CR(P)-2239 N87-10962 #
ESA-CR(P)-2240 N87-10961 #
ESA-CR(P)-2241 N87-11568 #
ESA-CR(P)-2245 N87-10954 #
ESA-CR(P)-2248 N87-10955 #
ESA-CR(P)-2249 N87-11116 #
ESA-CR(P)-2252 N87-11117 #
ESA-CR(P)-2253 N87-11477 #
ESA-CR(P)-2254 N87-11363 #
ESA-CR(P)-2256 N87-10881 #

ESA-SP-238 N87-10886 #
ESA-SP-247 N87-11238 #

ESA-TT-950 N87-10965 #
ESA-TT-959 N87-10990 #
ESA-TT-960 N87-11019 #
ESA-TT-964 N87-11131 #

ESL-86007-TR N87-11360 #

ESOC/85/1 N87-11632 #

ETN-86-97139 N87-10872 #
ETN-86-97563 N87-11238 #
ETN-86-97720 N87-11342
ETN-86-97758 N87-11064 #
ETN-86-97802 N87-11019 #
ETN-86-97803 N87-11131 #
ETN-86-97805 N87-11471 #
ETN-86-97806 N87-11472 #
ETN-86-97813 N87-11119 #
ETN-86-97823 N87-11549 #
ETN-86-97826 N87-11170 #
ETN-86-97827 N87-11230 #
ETN-86-97828 N87-11574
ETN-86-97831 N87-11367
ETN-86-97835 N87-11581 #
ETN-86-97836 N87-11013 #
ETN-86-97839 N87-11500 #
ETN-86-97844 N87-11655 #
ETN-86-97846 N87-11148 #
ETN-86-97847 N87-10857 #
ETN-86-97848 N87-10948 #
ETN-86-97849 N87-11361 #
ETN-86-97850 N87-10989 #
ETN-86-97851 N87-11362 #
ETN-86-97852 N87-11166 #
ETN-86-97853 N87-11614 #
ETN-86-97854 N87-11473 #
ETN-86-97855 N87-11545 #
ETN-86-97857 N87-11231 #
ETN-86-97880 N87-11232 #
ETN-86-97881 N87-11133 #
ETN-86-97888 N87-11582 #
ETN-86-97889 N87-11623 #
ETN-86-97891 N87-11664 #
ETN-86-97892 N87-11624 #
ETN-86-97893 N87-11564 #
ETN-86-97895 N87-11599 #
ETN-86-97896 N87-11583 #
ETN-86-97904 N87-11584 #
ETN-86-97905 N87-11585 #
ETN-86-97917 N87-11586 #
ETN-86-97918 N87-11625 #
ETN-86-97927 N87-11587 #
ETN-86-97928 N87-11682 #
ETN-86-97929 N87-11546 #
ETN-86-97930 N87-11588 #
ETN-86-97931 N87-11547 #
ETN-86-97932 N87-11617 #
ETN-86-97934 N87-11548 #
ETN-86-97936 N87-11495 #
ETN-86-97937 N87-11519 #
ETN-86-97938 N87-11539 #
ETN-86-97939 N87-11631 #
ETN-86-97942 N87-10873
ETN-86-97943 N87-10874
ETN-86-97944 N87-10875
ETN-86-97945 N87-10994
ETN-86-97948 N87-10832
ETN-86-97954 N87-11600 #
ETN-86-97955 N87-11490 #
ETN-86-97956 N87-11491 #
ETN-86-97957 N87-11484 #
ETN-86-97958 N87-11520 #
ETN-86-97959 N87-11132 #
ETN-86-97960 N87-11113 #
ETN-86-97961 N87-11601 #
ETN-86-97962 N87-11167 #
ETN-86-97963 N87-11485 #
ETN-86-97964 N87-11114 #
ETN-86-97969 N87-11168 #
ETN-86-97976 N87-11175
ETN-86-97977 N87-11130 #
ETN-86-97981 N87-10984 #
ETN-86-97982 N87-10963 #
ETN-86-97989 N87-11592
ETN-86-97990 N87-11153
ETN-86-97991 N87-11580
ETN-86-97993 N87-11176 #
ETN-86-98006 N87-11022
ETN-86-98008 N87-11496
ETN-86-98009 N87-11071
ETN-86-98011 N87-11023
ETN-86-98012 N87-11499
ETN-86-98013 N87-11518 #
ETN-86-98015 N87-10867 #
ETN-86-98016 N87-10868 #
ETN-86-98017 N87-11020 #
ETN-86-98018 N87-11627 #
ETN-86-98019 N87-11001 #
ETN-86-98020 N87-11578 #
ETN-86-98021 N87-11615 #
ETN-86-98022 N87-11616 #

ETN-86-98023 N87-11169 #
ETN-86-98024 N87-10983
ETN-86-98031 N87-11065 #
ETN-86-98048 N87-11521 #
ETN-86-98049 N87-11474 #
ETN-86-98050 N87-11475 #
ETN-86-98061 N87-11339 #
ETN-86-98062 N87-11340 #
ETN-86-98071 N87-11002 #
ETN-86-98073 N87-11235
ETN-86-98074 N87-10851
ETN-86-98078 N87-10886 #
ETN-86-98082 N87-10982 #
ETN-86-98083 N87-10956 #
ETN-86-98084 N87-10958 #
ETN-86-98085 N87-11066 #
ETN-86-98086 N87-11352 #
ETN-86-98090 N87-11497 #
ETN-86-98092 N87-11654 #
ETN-86-98093 N87-11632 #
ETN-86-98094 N87-11636 #
ETN-86-98095 N87-11638 #
ETN-86-98096 N87-11639 #
ETN-86-98098 N87-10885 #
ETN-86-98099 N87-10880 #
ETN-86-98100 N87-11016 #
ETN-86-98105 N87-10949 #
ETN-86-98106 N87-10950 #
ETN-86-98107 N87-10951 #
ETN-86-98108 N87-10952 #
ETN-86-98109 N87-11115 #
ETN-86-98110 N87-10953 #
ETN-86-98117 N87-10962 #
ETN-86-98118 N87-10961 #
ETN-86-98119 N87-11568 #
ETN-86-98123 N87-10954 #
ETN-86-98125 N87-10955 #
ETN-86-98126 N87-11116 #
ETN-86-98129 N87-11117 #
ETN-86-98130 N87-11477 #
ETN-86-98131 N87-11363 #
ETN-86-98133 N87-10881 #
ETN-86-98159 N87-11633 #
ETN-86-98160 N87-11496 #
ETN-86-98161 N87-11550 #
ETN-86-98163 N87-11570 #
ETN-86-98164 N87-11522 #
ETN-86-98170 N87-11523 #
ETN-86-98171 N87-11533 #
ETN-86-98172 N87-11524 #
ETN-86-98173 N87-11526 #
ETN-86-98174 N87-11634 #
ETN-86-98175 N87-11635 #
ETN-86-98177 N87-11525 #
ETN-86-98178 N87-11149 #
ETN-86-98179 N87-10878 #
ETN-86-98180 N87-11136 #
ETN-86-98184 N87-11003 #
ETN-86-98188 N87-10879 #
ETN-86-98190 N87-11134 #
ETN-86-98192 N87-11135 #
ETN-86-98206 N87-11647
ETN-86-98207 N87-11648
ETN-86-98208 N87-11605 #
ETN-86-98209 N87-11678
ETN-86-98210 N87-11355
ETN-86-98211 N87-11679
ETN-86-98212 N87-11680*
ETN-86-98213 N87-11356
ETN-86-98220 N87-10844 #
ETN-86-98238 N87-11649
ETN-86-98242 N87-10965 #
ETN-86-98245 N87-10990 #
ETN-86-98253 N87-11606 #
ETN-86-98254 N87-11067 #
ETN-86-98256 N87-11068 #
ETN-86-98260 N87-11650
ETN-86-98262 N87-11603
ETN-86-98263 N87-11661
ETN-86-98264 N87-11662*
ETN-86-98265 N87-11604
ETN-86-98272 N87-11552 #
ETN-86-98273 N87-11137 #
ETN-86-98276 N87-11017 #
ETN-86-98332 N87-11341 #
ETN-86-98333 N87-11602 #
ETN-86-98334 N87-11118 #
ETN-86-98410 N87-11609 #
ETN-86-98411 N87-10991 #
ETN-86-98458 N87-11527 #
ETN-86-98459 N87-11553 #
ETN-86-98460 N87-11554 #
ETN-86-98461 N87-11528 #
ETN-86-98462 N87-11565 #
ETN-86-98463 N87-11555 #
ETN-86-98464 N87-11171 #
ETN-86-98466 N87-11628 #
ETN-86-98469 N87-11556 #
ETN-86-98471 N87-11138 #
ETN-86-98472 N87-11571 #
ETN-86-98473 N87-11529 #
ETN-86-98474 N87-11637 #
ETN-86-98475 N87-11486 #
ETN-86-98476 N87-11540 #
ETN-86-98479 N87-11557 #
ETN-86-98480 N87-11541 #
ETN-86-98481 N87-11558 #
ETN-86-98483 N87-10845 #
ETN-86-98487 N87-11139 #
ETN-86-98488 N87-11172 #
ETN-86-98489 N87-11530 #
ETN-86-98490 N87-11004 #
ETN-86-98491 N87-10846 #
ETN-86-98492 N87-11233 #
ETN-86-98493 N87-10863 #
ETN-86-98501 N87-11354 #
ETN-86-98502 N87-11069 #
ETN-86-98503 N87-10957 #
ETN-86-98504 N87-11559 #
ETN-86-98505 N87-10847 #
ETN-86-98506 N87-11140 #
ETN-86-98507 N87-11560 #
ETN-86-98508 N87-11561 #
ETN-86-98510 N87-11551 #
ETN-86-98511 N87-11562 #
ETN-86-98512 N87-11563 #
ETN-86-98514 N87-11566 #
ETN-86-98530 N87-11173 #

FFA-TN-1986-23 N87-11231 #

FFA-139 N87-11545 #

FJSRL-TJ-86-0007 N87-11129 #

FNAL/PUB-86/81-A N87-11663 #

FOA-C-30419-E1,E3 N87-11341 #
FOA-C-30421-E4 N87-11602 #
FOA-C-30426-E N87-11118 #

FR-235/20-1 N87-11574

GAO/IMTEC-86-7 N87-11629 #

GB-PATENT-2-140-004-A N87-10983

GKSS-86/E/3 N87-11230 #

GPO-58-629 N87-11640 #
GPO-60-030 N87-11642 #
GPO-60-960 N87-11643 #

GRI-86/0007 N87-11005 #
GRI-86/0034 N87-10992 #

GTS-84051 N87-11566 #

H-REPT-99-829 N87-11640 #
H-REPT-99-829 N87-11641 #

H-1179 N87-10871* #
H-1257 N87-10861* #

HEDL-7538-VOL-2 N87-11591 #

HEL-TN-2-86 N87-11487 #

HPSA/RPT/8071 N87-11352 #

H1-06/85-23 N87-11582 #

IAF-86-183 N87-10959* #

IC-84/160 N87-11610 #

ICASE-86-41 N87-11509* #
ICASE-86-57 N87-11127* #
ICASE-86-59 N87-11125* #

ICW-1659 N87-11339 #
ICW-1687 N87-11340 #

IFUP-TH-84/40 N87-11495 #

INF-84-18 N87-11633 #
INF-85-3 N87-11496 #
INF-85-5 N87-11550 #
INF-85-10 N87-11570 #
INF-85-13 N87-11522 #
INF-85-21 N87-11523 #
INF-85-22 N87-11533 #
INF-85-23 N87-11524 #
INF-85-24 N87-11526 #
INF-85-26 N87-11634 #
INF-85-29 N87-11635 #

INFORM-SHEET-587 N87-11168 #

INT.CLASSC07C27/2253/1253/12 N87-10983

IPF-85-2 N87-11067 #
IPF-86-2 N87-11068 #

IR-59 N87-10976* #
IR-60 N87-10977* #

IS-M-585 N87-11228 #

ISBN-3-88148-226-1 N87-11367
ISBN-90-220-0866-5 N87-11235
ISBN-90-357-0388-3 N87-10851
ISBN-90-365-0021-4 N87-11526 #

ISSN-017-1342 N87-11017 #
ISSN-079-6566 N87-11236 #
ISSN-0072-4122 N87-11367
ISSN-0143-7313 N87-11592
ISSN-0168-552X N87-10851
ISSN-0169-1651 N87-11069 #
ISSN-0169-1651 N87-11354 #
ISSN-0169-2690 N87-11566 #
ISSN-0170-1339 N87-10857 #
ISSN-0170-1339 N87-10948 #
ISSN-0170-1339 N87-11148 #
ISSN-0170-1339 N87-11655 #
ISSN-0171-1342 N87-10879 #
ISSN-0171-1342 N87-11003 #
ISSN-0171-1342 N87-11136 #
ISSN-0176-7739 N87-10878 #
ISSN-0176-7739 N87-11149 #
ISSN-0176-7739 N87-11525 #
ISSN-0178-0719 N87-11603
ISSN-0178-0719 N87-11604
ISSN-0178-0719 N87-11661
ISSN-0178-0719 N87-11662*
ISSN-0303-4003 N87-11013 #
ISSN-0303-4003 N87-11134 #
ISSN-0303-4003 N87-11135 #
ISSN-0303-4003 N87-11581 #
ISSN-0309-3069 N87-11153
ISSN-0340-8922 N87-11647
ISSN-0344-9629 N87-11230 #
ISSN-0347-3708 N87-11118 #
ISSN-0347-3708 N87-11341 #
ISSN-0347-3708 N87-11602 #
ISSN-0349-0068 N87-11473 #
ISSN-0349-2656 N87-10989 #
ISSN-0349-2656 N87-11361 #
ISSN-0349-2656 N87-11362 #
ISSN-0379-6566 N87-10886 #
ISSN-0436-1199 N87-10844 #

IW-R511 N87-10845 #

JBE/SB-443.524/85 N87-10672 #

JPL-TDA-PR-42-86 N87-11024* #

KFK-PFT-119 N87-11500 #

KFK-4036 N87-11581 #
KFK-4060 N87-11013 #
KFK-4070 N87-11134 #
KFK-4082 N87-11135 #

KGI-PREPRINT-087 N87-11361 #
KGI-PREPRINT-088 N87-10989 #
KGI-PREPRINT-089 N87-11362 #

KNMI-WR-86-1 N87-11354 #
KNMI-WR-86-2(GO) N87-11069 #

KU-FRL-568-1 N87-10862* #

L-15742 N87-10838* #
L-15766 N87-10839* #
L-15811 N87-10870* #
L-16116 N87-10864* #
L-16147 N87-10843* #
L-16176 N87-11358* #
L-16183 N87-11589* #

LA-UR-86-996 N87-11156 #
LA-UR-86-1288 N87-11537 #
LA-UR-86-1877 N87-11157 #
LA-UR-86-2084 N87-11573 #

LA-10727-MS ..... N87-11674 #

LA/SUB-D2121G-1 ..... N87-11164 #

LBL-20497 ..... N87-11112 #
LBL-20663 ..... N87-10966 #
LBL-21470 ..... N87-10964 #

LG85ER0012-REV ..... N87-10866* #

LIDS-TH-1609 ..... N87-11567* #

LITERATUUROVERZICHT-42 ..... N87-11235

LMI-DL503 ..... N87-11630 #

LMSC/F134561 ..... N87-11681 #
LMSC/F146531 ..... N87-11681 #

LP-213 ..... N87-11609 #

LR46186-VOL-1 ..... N87-11490 #
LR46186-VOL-2 ..... N87-11491 #
LR46994 ..... N87-11484 #
LR47282 ..... N87-11132 #
LR47589 ..... N87-11520 #
LR47662 ..... N87-11167 #
LR47675 ..... N87-11113 #
LR48041 ..... N87-11600 #
LR48619 ..... N87-11485 #
LR48626 ..... N87-11114 #
LR48758 ..... N87-11168 #

MATRA-CMT-138-JPG-078-85 ..... N87-10953 #

MBB-R-0200/3069-R ..... N87-11066 #

MCR-84-549-APP-A ..... N87-11534* #
MCR-84-549-APP-B ..... N87-11535* #
MCR-85-665-APP-A ..... N87-11536* #

MEAH-84 ..... N87-11139 #

MPE-PREPRINT-26 ..... N87-11647
MPE-PREPRINT-32 ..... N87-11649
MPE-PREPRINT-33 ..... N87-11648
MPE-PREPRINT-39 ..... N87-11650
MPE-PREPRINT-43 ..... N87-11603
MPE-PREPRINT-44 ..... N87-11661
MPE-PREPRINT-45 ..... N87-11662*
MPE-PREPRINT-46 ..... N87-11604
MPE-PREPRINT-47 ..... N87-11605 #
MPE-PREPRINT-48 ..... N87-11678
MPE-PREPRINT-49 ..... N87-11355
MPE-PREPRINT-51 ..... N87-11679
MPE-PREPRINT-52 ..... N87-11680*
MPE-PREPRINT-53 ..... N87-11356

MPIS-22/1985 ..... N87-10844 #

MQAD-R-343 ..... N87-10984 #

MQAD-TR-010 ..... N87-10963 #

MTI-86TR40 ..... N87-11158* #

NAS 1.15:85756 ..... N87-10869* #
NAS 1.15:85909 ..... N87-10861* #
NAS 1.15:85948 ..... N87-11143* #
NAS 1.15:87239 ..... N87-11543* #
NAS 1.15:88845 ..... N87-11124* #
NAS 1.15:88848 ..... N87-10959* #
NAS 1.15:88865 ..... N87-10960* #
NAS 1.15:88873 ..... N87-11345* #
NAS 1.15:88995 ..... N87-11589* #
NAS 1.15:89005 ..... N87-11105* #
NAS 1.15:89018 ..... N87-11177* #
NAS 1.15:89019 ..... N87-11506* #
NAS 1.15:89045 ..... N87-11010* #
NAS 1.15:89048 ..... N87-10945* #
NAS 1.15:89232 ..... N87-10977* #
NAS 1.15:89253 ..... N87-11008* #
NAS 1.26:3606 ..... N87-10836* #
NAS 1.26:3710 ..... N87-10973* #
NAS 1.26:3711 ..... N87-10975* #
NAS 1.26:3715 ..... N87-10974* #
NAS 1.26:3747 ..... N87-10837* #
NAS 1.26:3806 ..... N87-10829* #
NAS 1.26:3922(09) ..... N87-11478* #
NAS 1.26:4024 ..... N87-10854* #
NAS 1.26:166606 ..... N87-10862* #
NAS 1.26:171911 ..... N87-11481* #
NAS 1.26:172342 ..... N87-10842* #
NAS 1.26:172355 ..... N87-10860* #
NAS 1.26:172385 ..... N87-11507* #
NAS 1.26:172402 ..... N87-11534* #
NAS 1.26:172403 ..... N87-11535* #
NAS 1.26:172428 ..... N87-11576* #
NAS 1.26:172440 ..... N87-10884* #
NAS 1.26:172458 ..... N87-11179* #
NAS 1.26:172494 ..... N87-10859* #
NAS 1.26:172495 ..... N87-11343* #
NAS 1.26:174676 ..... N87-10835* #
NAS 1.26:174773 ..... N87-11144* #
NAS 1.26:174819 ..... N87-10840* #
NAS 1.26:174845 ..... N87-10866* #
NAS 1.26:174922 ..... N87-10946* #
NAS 1.26:174961 ..... N87-11348* #
NAS 1.26:175075 ..... N87-11347* #
NAS 1.26:175117 ..... N87-11346* #
NAS 1.26:175118 ..... N87-11344* #
NAS 1.26:177058 ..... N87-11007* #
NAS 1.26:177186 ..... N87-11463* #
NAS 1.26:177188 ..... N87-11670* #
NAS 1.26:178051 ..... N87-11536* #
NAS 1.26:178131 ..... N87-11509* #
NAS 1.26:178175 ..... N87-11125* #
NAS 1.26:178178 ..... N87-11127* #
NAS 1.26:178185 ..... N87-11577* #
NAS 1.26:178903 ..... N87-10944* #
NAS 1.26:178919 ..... N87-11676* #
NAS 1.26:179479 ..... N87-11056* #
NAS 1.26:179480 ..... N87-11057* #
NAS 1.26:179501 ..... N87-11158* #
NAS 1.26:179703 ..... N87-11236* #
NAS 1.26:179706 ..... N87-10883* #
NAS 1.26:179715 ..... N87-11024* #
NAS 1.26:179782 ..... N87-11508* #
NAS 1.26:179784 ..... N87-11651* #
NAS 1.26:179798 ..... N87-10828* #
NAS 1.26:179799 ..... N87-10972* #
NAS 1.26:179803 ..... N87-11353* #
NAS 1.26:179807 ..... N87-11178* #
NAS 1.26:179810 ..... N87-11006* #
NAS 1.26:179814 ..... N87-11618* #
NAS 1.26:179822 ..... N87-11542* #
NAS 1.26:179827 ..... N87-11575* #
NAS 1.26:179830 ..... N87-11104* #
NAS 1.26:179832 ..... N87-11123* #
NAS 1.26:179833 ..... N87-11142* #
NAS 1.26:179836 ..... N87-11619* #
NAS 1.26:179857 ..... N87-11009* #
NAS 1.26:179863 ..... N87-11672* #
NAS 1.26:179885 ..... N87-11653* #
NAS 1.26:179867 ..... N87-10976* #
NAS 1.26:179868 ..... N87-11126* #
NAS 1.26:179869 ..... N87-11512* #
NAS 1.26:179874 ..... N87-11510* #
NAS 1.26:179876 ..... N87-11336* #
NAS 1.26:179877 ..... N87-11159* #
NAS 1.26:179879 ..... N87-11652* #
NAS 1.26:179881 ..... N87-11671* #
NAS 1.26:179888 ..... N87-11673* #
NAS 1.26:179889 ..... N87-11511* #
NAS 1.26:179891 ..... N87-11567* #
NAS 1.26:179895 ..... N87-11237* #
NAS 1.55:2339 ..... N87-11180* #
NAS 1.55:2434 ..... N87-11072* #
NAS 1.60:2222 ..... N87-10871* #
NAS 1.60:2350 ..... N87-10870* #
NAS 1.60:2352 ..... N87-10838* #
NAS 1.60:2364 ..... N87-10839* #
NAS 1.60:2375 ..... N87-10841* #
NAS 1.60:2616 ..... N87-10864* #
NAS 1.60:2633 ..... N87-10843* #
NAS 1.61:1146 ..... N87-10876* #
NAS 1.61:1172 ..... N87-11358* #

NASA-CP-2339 ..... N87-11180* #
NASA-CP-2434 ..... N87-11072* #

NASA-CR-3606 ..... N87-10836* #
NASA-CR-3710 ..... N87-10973* #
NASA-CR-3711 ..... N87-10975* #
NASA-CR-3715 ..... N87-10974* #
NASA-CR-3747 ..... N87-10837* #
NASA-CR-3806 ..... N87-10829* #
NASA-CR-3922(09) ..... N87-11478* #
NASA-CR-4024 ..... N87-10854* #
NASA-CR-166606 ..... N87-10862* #
NASA-CR-171911 ..... N87-11481* #
NASA-CR-172342 ..... N87-10842* #
NASA-CR-172355 ..... N87-10860* #
NASA-CR-172385 ..... N87-11507* #
NASA-CR-172402 ..... N87-11534* #
NASA-CR-172403 ..... N87-11535* #
NASA-CR-172428 ..... N87-11576* #
NASA-CR-172440 ..... N87-10884* #
NASA-CR-172458 ..... N87-11179* #
NASA-CR-172494 ..... N87-10859* #
NASA-CR-172495 ..... N87-11343* #
NASA-CR-174676 ..... N87-10835* #
NASA-CR-174773 ..... N87-11144* #
NASA-CR-174819 ..... N87-10840* #
NASA-CR-174845 ..... N87-10866* #
NASA-CR-174922 ..... N87-10946* #
NASA-CR-174961 ..... N87-11348* #
NASA-CR-175075 ..... N87-11347* #
NASA-CR-175117 ..... N87-11346* #
NASA-CR-175118 ..... N87-11344* #
NASA-CR-177058 ..... N87-11007* #
NASA-CR-177186 ..... N87-11463* #
NASA-CR-177188 ..... N87-11670* #
NASA-CR-178051 ..... N87-11536* #
NASA-CR-178131 ..... N87-11509* #
NASA-CR-178175 ..... N87-11125* #
NASA-CR-178178 ..... N87-11127* #
NASA-CR-178185 ..... N87-11577* #
NASA-CR-178903 ..... N87-10944* #
NASA-CR-178919 ..... N87-11676* #
NASA-CR-179479 ..... N87-11056* #
NASA-CR-179480 ..... N87-11057* #
NASA-CR-179501 ..... N87-11158* #
NASA-CR-179703 ..... N87-11236* #
NASA-CR-179706 ..... N87-10883* #
NASA-CR-179715 ..... N87-11024* #
NASA-CR-179782 ..... N87-11508* #
NASA-CR-179784 ..... N87-11651* #
NASA-CR-179798 ..... N87-10828* #
NASA-CR-179799 ..... N87-10972* #
NASA-CR-179803 ..... N87-11353* #
NASA-CR-179807 ..... N87-11178* #
NASA-CR-179810 ..... N87-11006* #
NASA-CR-179814 ..... N87-11618* #
NASA-CR-179822 ..... N87-11542* #
NASA-CR-179827 ..... N87-11575* #
NASA-CR-179830 ..... N87-11104* #
NASA-CR-179832 ..... N87-11123* #
NASA-CR-179833 ..... N87-11142* #
NASA-CR-179836 ..... N87-11619* #
NASA-CR-179857 ..... N87-11009* #
NASA-CR-179863 ..... N87-11672* #
NASA-CR-179865 ..... N87-11653* #
NASA-CR-179867 ..... N87-10976* #
NASA-CR-179868 ..... N87-11126* #
NASA-CR-179869 ..... N87-11512* #
NASA-CR-179874 ..... N87-11510* #
NASA-CR-179876 ..... N87-11336* #
NASA-CR-179877 ..... N87-11159* #
NASA-CR-179879 ..... N87-11652* #
NASA-CR-179881 ..... N87-11671* #
NASA-CR-179888 ..... N87-11673* #
NASA-CR-179889 ..... N87-11511* #
NASA-CR-179891 ..... N87-11567* #
NASA-CR-179895 ..... N87-11237* #

NASA-NEWS-REL-86-147 ..... N87-11335* #

NASA-RP-1146 ..... N87-10876* #
NASA-RP-1172 ..... N87-11358* #

NASA-TM-85758 ..... N87-10869* #
NASA-TM-85909 ..... N87-10861* #
NASA-TM-85948 ..... N87-11143* #
NASA-TM-87329 ..... N87-11543* #
NASA-TM-88845 ..... N87-11124* #
NASA-TM-88848 ..... N87-10959* #
NASA-TM-88865 ..... N87-10960* #
NASA-TM-88873 ..... N87-11345* #
NASA-TM-88995 ..... N87-11589* #
NASA-TM-89005 ..... N87-11105* #
NASA-TM-89018 ..... N87-11177* #
NASA-TM-89019 ..... N87-11506* #
NASA-TM-89045 ..... N87-11010* #
NASA-TM-89048 ..... N87-10945* #
NASA-TM-89232 ..... N87-10977* #
NASA-TM-89253 ..... N87-11008* #

NASA-TP-2222 ..... N87-10871* #
NASA-TP-2350 ..... N87-10870* #
NASA-TP-2352 ..... N87-10838* #
NASA-TP-2364 ..... N87-10839* #
NASA-TP-2375 ..... N87-10841* #
NASA-TP-2616 ..... N87-10864* #
NASA-TP-2633 ..... N87-10843* #

NBS-TN-1093 ..... N87-11150 #
NBS-TN-1220 ..... N87-11151 #

NLR-MP-84089-U ..... N87-11065 #
NLR-MP-85012-U ..... N87-11172 #
NLR-MP-85013-U ..... N87-11530 #
NLR-MP-85029-U ..... N87-11004 #
NLR-MP-85040-U ..... N87-10846 #
NLR-MP-85050-U ..... N87-11233 #
NLR-MP-85058-U ..... N87-10863 #

NOSC/TR-1067 ..... N87-11063 #

NOTA-INTERNA-839 N87-11495 #
NOTA-INTERNA-854 N87-11582 #
NOTA-INTERNA-855 N87-11623 #
NOTA-INTERNA-857 N87-11684 #
NOTA-INTERNA-858 N87-11624 #
NOTA-INTERNA-859 N87-11564 #
NOTA-INTERNA-862 N87-11599 #
NOTA-INTERNA-863 N87-11583 #

NPL-MOM-77 N87-11592
NPL-MOM-78 N87-11153

NPL-RS(EXT)-81 N87-11580

NRL-MR-5792 N87-11606 #

NYSERDA-85-20 N87-11141 #

OEFZS-4351 N87-11133 #
OEFZS-4352 N87-11232 #

ORNL/SUB-80-7843/01 N87-10996 #
ORNL/SUB-84-9009/1 N87-11011 #

ORNL/TM-9904 N87-10947 #
ORNL/TM-10087 N87-11147 #

PATENT-APPL-8314139 N87-10983

PB86-201274 N87-11151 #
PB86-202991 N87-11150 #
PB86-203205 N87-10992 #
PB86-206364 N87-11021 #
PB86-206562 N87-11070 #
PB86-212396 N87-11141 #
PB86-213665 N87-11365 #
PB86-213873 N87-11364 #
PB86-213964 N87-11005 #
PB86-222429 N87-10831 #

PNL-SA-13820 N87-11626 #
PNL-SA-14013 N87-11489 #

PNR-90294 N87-11518 #
PNR-90298 N87-10867 #
PNR-90305 N87-10868 #
PNR-90306 N87-11020 #
PNR-90307 N87-11627 #
PNR-90310 N87-11001 #
PNR-90315 N87-11578 #
PNR-90319 N87-11615 #
PNR-90320 N87-11616 #

PPI-FID-300101-VOL-1 N87-11348* #

PREPRINT-97 N87-11137 #
PREPRINT-469 N87-11584 #
PREPRINT-470 N87-11585 #
PREPRINT-482 N87-11586 #
PREPRINT-483 N87-11625 #
PREPRINT-494 N87-11587 #
PREPRINT-495 N87-11682 #
PREPRINT-497 N87-11546 #
PREPRINT-498 N87-11588 #
PREPRINT-499 N87-11547 #
PREPRINT-500 N87-11617 #
PREPRINT-503 N87-11548 #
PREPRINT-980 N87-11552 #

PS-4 N87-10954 #

QPR-3 N87-11508* #

QR-17 N87-11347* #
QR-18 N87-11346* #
QR-19 N87-11344* #

RA/6/16/85 N87-10875

RADC-TR-85-226 N87-11597 #
RADC-TR-85-241 N87-11110 #
RADC-TR-85-275 N87-11111 #
RADC-TR-86-2 N87-11596 #
RADC-TR-86-8 N87-11061 #
RADC-TR-86-26 N87-11059 #

RAE-TM-MAT/STR-1065 N87-11176 #

REPT-JMH/GB/GR/769-84 N87-11117 #

REPT-71.4601 N87-11636 #
REPT-84-1 N87-11521 #
REPT-84-2 N87-11474 #
REPT-84-4 N87-11475 #
REPT-84-001 N87-11576* #
REPT-85-23 N87-11527 #
REPT-85-24 N87-11553 #
REPT-85-28 N87-11554 #
REPT-85-29 N87-11528 #
REPT-85-31 N87-11565 #
REPT-85-32 N87-11555 #
REPT-85-34 N87-11171 #
REPT-85-36 N87-11519 #
REPT-85-36 N87-11628 #
REPT-85-39 N87-11556 #
REPT-85-41 N87-11138 #
REPT-85-42 N87-11571 #
REPT-85-43 N87-11529 #
REPT-85-44 N87-11637 #
REPT-85-45 N87-11486 #
REPT-85-46 N87-11540 #
REPT-85-49 N87-11557 #
REPT-85-50 N87-11541 #
REPT-85-51 N87-11558 #
REPT-86-001 N87-11519 #
REPT-86-002 N87-11539 #
REPT-86-004 N87-11831 #
REPT-86B0366 N87-11072* #
REPT-306 N87-11463* #
REPT-6216-019 N87-10855 #

RPT/CRY/62351/BO N87-11654 #

RR-288 N87-11169 #

RS-271/86 N87-11133 #

RSRE-MEMO-3696 N87-11022
RSRE-MEMO-3901 N87-11496
RSRE-MEMO-3907 N87-11071
RSRE-MEMO-3919 N87-11023
RSRE-MEMO-3924 N87-11499

RT-OA-63/1685 N87-10834 #

RTCA/DO-132A-REV N87-10853 #
RTCA/DO-192 N87-10853 #

R84-925830-33 N87-11144* #
R86-21 N87-11483* #

S-HRG-99-691 N87-11642 #

SAND-85-2411C N87-11611 #
SAND-85-2455C N87-11012 #
SAND-85-2764 N87-10856 #
SAND-85-2843 N87-11336 #
SAND-85-7021 N87-11351 #
SAND-85-7023 N87-11350 #
SAND-86-0428C N87-11486 #
SAND-86-1321C N87-11229 #
SAND-86-2060C N87-10999 #

SAPR-12 N87-11651* #

SAR-2 N87-11159* #

SASR-3 N87-11575* #

SD-TR-86-19 N87-11060 #

SGD-500-PT-1 N87-11365 #
SGD-500-PT-2 N87-11364 #

SLAC-PUB-3961 N87-11622 #

SLCET-TR-86-6 N87-11018 #

SNIAS-86-CA/LL/O N87-11477 #
SNIAS-861-111-101 N87-10872 #

SU-SOL-86-10 N87-11569 #

TR-14 N87-10978 #
TR-15 N87-10979 #
TR-516 N87-11513 #
TR-0086(6925-06)-1 N87-11060 #

TW-269 N87-10957 #
TW-270 N87-11559 #

UAH-530 N87-11676* #

UCB/RP-85/D1034 N87-10996 #

UCRL-15769 N87-11469 #
UCRL-15775 N87-11468 #
UCRL-15776 N87-11467 #
UCRL-93549 N87-11470 #
UCRL-94173 N87-11165 #
UCRL-94338 N87-11465 #
UCRL-94340 N87-11517 #
UCRL-94719 N87-11162 #

UILU-EM-84-15 N87-11061 #

UILU-ENG-86-1731 N87-11518 #

UIUCDCS-R-86-1277 N87-11516 #

US-PATENT-APPL-SN-545307 N87-11106 #
US-PATENT-APPL-SN-550286 N87-11145 #
US-PATENT-APPL-SN-569644 N87-11058 #
US-PATENT-APPL-SN-583549 N87-11152 #
US-PATENT-APPL-SN-604547 N87-11109 #
US-PATENT-APPL-SN-615504 N87-11584 #
US-PATENT-APPL-SN-615612 N87-11583 #
US-PATENT-APPL-SN-643138 N87-11154 #
US-PATENT-APPL-SN-643201 N87-11107 #

US-PATENT-CLASS-250-316.1 N87-11154 #
US-PATENT-CLASS-324-158 N87-11145 #
US-PATENT-CLASS-330-61R N87-11109 #
US-PATENT-CLASS-332-9T N87-11107 #
US-PATENT-CLASS-350-96.19 N87-11106 #
US-PATENT-CLASS-350-354 N87-11583 #
US-PATENT-CLASS-356-350 N87-11152 #
US-PATENT-CLASS-370-38 N87-11058 #
US-PATENT-CLASS-378-84 N87-11584 #

US-PATENT-4,563,641 N87-11145 #
US-PATENT-4,564,935 N87-11058 #
US-PATENT-4,571,024 N87-11106 #
US-PATENT-4,573,767 N87-11583 #
US-PATENT-4,573,797 N87-11152 #
US-PATENT-4,577,103 N87-11154 #
US-PATENT-4,577,166 N87-11107 #
US-PATENT-4,578,804 N87-11584 #
US-PATENT-4,585,999 N87-11109 #

USAAVSCOM-TR-86-C-33 N87-11124* #
USAAVSCOM-TR-86-C-34 N87-11158* #

USAFSAM-TR-85-105 N87-11479 #

USARIEM-M-24/86 N87-11482 #

USIP-86-03 N87-11614 #

UVA/528190/AM87/112 N87-11542* #
UVA/528320/MS87/103-SUPP-3 N87-11619* #

VKI-LS-1986-04-VOL-2 N87-11119 #

VPI-E-86-12 N87-10976* #
VPI-E-86-19 N87-10977* #

WB/AHD-211 N87-11139 #

WCP-110 N87-11471 #
WCP-111 N87-11472 #

WE-369/86 N87-11232 #

WES/TR/GL-86-4 N87-10877 #

WMO/TD-93 N87-11471 #
WMO/TD-94 N87-11472 #

WP-1 N87-11342

WPB-0132 N87-11173 #

YALEU/DCS/RR-459 N87-11515 #
YALEU/DCS/RR-461 N87-11531 #
YALEU/DCS/RR-462 N87-11514 #

2339212320 N87-11152 #

U.S. GOVERNMENT PRINTING OFFICE: 1987-181-546/40024

FEDERAL DEPOSITORY LIBRARIES

ALABAMA

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

ARIZONA

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor—State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Government Documents Dept.
Tucson, AZ 85721
(602) 626-5233

ARKANSAS

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

CALIFORNIA

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

COLORADO

UNIV OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

FLORIDA

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

GEORGIA

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

HAWAII

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

IDAHO

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

IOWA

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

KANSAS

UNIVERSITY OF KANSAS
Doc. Collect—Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

KENTUCKY

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

MAINE

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

MARYLAND

UNIVERSITY OF MARYLAND
McKeldin Lib.—Doc. Div.
College Park, MD 20742
(301) 454-3034

MASSACHUSETTS

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext.226

MICHIGAN

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodard Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

MINNESOTA

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

MISSISSIPPI

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

MONTANA

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
In cooperation with University of Nebraska-Lincoln

NEVADA

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEW JERSEY

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

NEW MEXICO

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

NORTH DAKOTA

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
In cooperation with North Dakota State Univ. Library

OHIO

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA

OKLAHOMA DEPT. OF LIB.
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

OREGON

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

PENNSYLVANIA

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927—Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

VIRGINIA

UNIVERSITY OF VIRGINIA
Alderman Lib.—Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

National Aeronautics and
Space Administration
Code NTT-4
Washington, D.C.
20546

Official Business

Penalty for Private Use, $300

SPECIAL FOURTH-CLASS RATE
POSTAGE & FEES PAID
NASA
PERMIT No. G 27

NASA

POSTMASTER: If Undeliverable (Section 158
Postal Manual) Do Not Return